MEMORANDUM

TO: Forest Practices Board

FROM: Garren Andrews, Compliance Monitoring Program Manager

SUBJECT: Current status of the Compliance Monitoring Program

Todd Olson accepted the Compliance Monitoring Field Coordinator position. Todd's start date with the Compliance Monitoring Program was October 5•h.

The Compliance Monitoring program has completed 2015 field reviews.

The 2014 ***Interim*** Compliance Monitoring report has been completed. The report has been posted on the Department of Natural Resources Forest Practices website.

If you have any questions please contact me at (360) 902-1366 or garren.andrews@dnr.wa.gov

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RESOURCES

NATURAL

2014 Interim Forest Practices Compliance Monitoring Report

October 2015

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

2014 Interim Forest Practices Compliance Monitoring Report

October 2015

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1. Acknowledgments

This annual report is dedicated to Walt Obermeyer. Walt worked for the Washington State Department of Natural Resources for 29 years and in the Compliance Monitoring Program from 2009 to 2015. Walt will be missed.

The contributions of the following were critical to the completion of this report: The tribal staff and regional staffs of the Washington State Departments of Ecology, Fish and Wildlife, and Natural Resources who performed field reviews in good weather and bad, with special thanks to those who reviewed and entered data, including Monica McMackin, Matthew Provencher, Jean Parodi, and John Heimburg. Also thanks to the Forest Practices Division leadership who patiently reviewed various drafts.

2. Executive Summary

The Compliance Monitoring Program (CMP) is a key component of the Washington State Department of Natural Resources' (DNR's) Forest Practices Program (FP Program). Compliance monitoring is linked to DNR's responsibility to ensure that operators and landowners are complying with forest practices rules (FP rules) when conducting forest practices activities. Through monitoring, the CMP provides feedback to the FP Program regarding the degree to which specific FP rules are being implemented correctly and highlights where there is a need for focus, training, or clarity.

The CMP reports on real-world compliance on the ground. The FP rules direct DNR to provide "statistically sound, biennial compliance audits and monitoring reports to the [Forest Practices] Board for consideration and support of rule and guidance analysis" (WAC 222-08-160[4]). In addition to the biennial report produced by the CMP, in 2011 the commissioner of public lands requested an annual report in the intervening years.

This interim CMP report covers data samples collected during the 2014 field season (first year of the biennial cycle). Sample sizes in an annual report are too small to provide robust statistical estimates because observation and data collection are based on a 2-year model, with approximately half the samples observed in the first year and half the samples observed in the second year. Two years are needed to obtain enough samples to attain the desired level of statistical precision. Consequently, with only half of the sample data represented, the findings, conclusions, and recommendations in an annual or interim report are limited. The data from the 2014 and 2015 field seasons will be combined to produce the desired precision for statistical estimates. The resulting comprehensive findings, conclusions, and recommendations will be reported in the 2014–2015 biennial report scheduled for 2016. Annual reports provide the interim status of CMP sampling, allowing the CMP to convey results from Emphasis Samples completed in the first year of the biennial cycle a year earlier than does a biennial report.

The CMP evaluates compliance with prioritized FP rules considered to have the greatest impact on public resources, defined as water, fish, wildlife, and capital improvements of the state. The rule groupings evaluated by compliance monitoring pertain to riparian and wetland areas and to road construction and maintenance.

Sample Design and Methodology

For the purposes of monitoring and statistical analysis, individual FP rules are grouped into categories of similar rules called "prescriptions." Separate samples are chosen for each prescription type monitored. Estimated populations for individual prescriptions are associated with forest practices applications (FPAs) that include forest practices activities, such as timber harvest or road construction. Sample selections for each prescription type are drawn from the FPAs that contain the prescriptions being monitored that year (numbers in parentheses indicate the estimated population of FPAs with the prescription in the 2014 sample): Roads (591), Type A&B Wetlands (53), Forested Wetlands (104), No Inner Zone Harvest (NIZH) (264), Desired Future Condition Option 1 (DFC1) (18), Desired Future Condition Option 2 (DFC2) (49), Non-

Fish-Bearing Perennial Stream (Np) (322), and Non-Fish-Bearing Seasonal Stream (Ns) (356). For this 2014 interim report, 81 prescriptions were sampled.

FP rules monitored annually are referred to as the Standard Sample. In addition, certain rule groups are monitored periodically and are known as an Emphasis Sample. The Standard Sample monitors the following rules:

- Riparian protection (WAC 222-30-021 and 022)
- Wetland protection (WAC 222-30-020[6] and [7] and WAC 222-24-015)
- Road construction, maintenance, and abandonment (WAC 222-24)
- Haul routes for sediment delivery (WAC 222-24)

In addition, the physical criteria of waters (e.g., stream width, stream gradient, etc.) are observed to estimate the number of occurrences in which water types recorded on FPAs are different than what is observed on the ground (WAC 222-16-031).

Changes in Study Design

The CMP made significant modifications in the 2014 study design to increase precision in statistical estimates for each prescription type observed. Previously, compliance rates were estimated by dividing 100% compliant samples by the total number of samples for each prescription type. The updated study design divides the number of compliant rules by the number of total sampled rules within each prescription type, resulting in an average compliance rate. This change increases statistical precision in results and provides more information to help determine causes of noncompliance associated with rule interpretation and implementation. The modified design adds flexibility for future sampling to add or remove different prescription types from the sample as needed, while still providing the desired confidence intervals for each prescription type. The No Inner Zone Harvest and No Outer Zone Harvest prescriptions have been combined.

Notable Aspects of CMP Samples

- FPAs are randomly selected.
- Conclusions on average compliance are based on a 2-year window, with approximately half the samples observed in the first year and half the samples observed in the second year. Two years are needed to obtain enough samples to attain the desired level of statistical precision. This report represents only 1 year of data collection.
- The CMP establishes sample sizes based on an estimated 95% confidence interval width of +/– 6% on compliance estimates.
- CMP results are reported for all the landowners combined.
- The Compliant percentages reported for all sampled prescriptions, except the Haul Route prescription, reflect average compliance for the prescription. Compliance with individual rules within the prescription are summed to calculate the percentage of prescription compliance rates.
- The Haul Route prescription type follows a different sample design. The Compliant percentages reported for the Haul Routes prescription are overall rates of compliance

with FP rules for haul routes (instead of the percentage of the sample compliant). See Section 4 for more information.

- A rule application assessed as compliant is rated either Compliant or Exceeds Rule Requirements, the latter when a landowner implements higher protection standards than required by FP rules.
- When a prescription is assessed as a deviation, it is rated either Low, Moderate, High, or Indeterminate to provide the degree of deviation from rule or FPA requirements.
- Compliance is determined both for compliance of the forest practices activity implementation with FP rules, called "rule compliance," and for compliance of the forest practices activity implementation with what was stated on the FPA, called "FPA compliance."

Findings

Findings from the 2014 sampling season are reported in Sections 3 and 4 of this report. It is important to remember that compliance monitoring findings only represent 1 year of the required 2 years of data needed for precise estimates. Statistically based conclusions cannot be made for samples that have 1 year of data.

Water Typing

Additional relevant data and results for water typing are located in Section 3. Supplemental Water Information Forms (SWIFs) were completed for 12 samples due to water typing discrepancies. Four waters were underclassified, 5 waters were overclassified, and 3 waters were indeterminate.

Riparian Management Zones

Additional relevant data and results for RMZs are located in Section 3. The DFC1 rate of compliance for the 2014 sample period was 94.6%. The DFC2 rate of compliance was 97.7%. The NIZH rate of compliance was 92%. The Np activity rate of compliance was 98%. The Ns activity rate of compliance was 96%.

Wetland Management Zones

Additional relevant data and results for WMZs are located in Section 3. The Type A&B Wetlands rate of compliance for the 2014 sample period was 98%. The Forested Wetlands rate of compliance was 94%.

Roads

Additional relevant data and results for the Roads prescription are located in Section 4. The Roads rate of compliance for the 2014 sample period was 95.7%.

Haul Routes

The rate of compliance for the Haul Routes prescription in the 2014 sample period was 91%.

Changes Made Based on CMP Feedback

A primary goal of the CMP is to provide feedback from compliance monitoring for the purposes of improving compliance with FP rules. The following are some recent changes made to address issues identified as a result of compliance monitoring: Leave tree, DFC, and RMZ length rule and Forest Practices Board Manual clarifications are currently under review and will be completed by 2016. Rule and Board Manual clarifications have been incorporated into the Forest Practices Board work plan.

3. Introduction

Photo by: Doug Couvelier

Compliance monitoring is a component of the Washington State Forest Practices Program. Section 1 gives a brief history leading to the development of the Compliance Monitoring Program and explains key factors and concepts regarding compliance monitoring and the forest practices rules that are monitored.

3.1 History and Context

The 1974 Forest Practices Act (FP Act) declared that "forest land resources are among the most valuable of all resources in the state" (Revised Code of Washington [RCW], Title 76.09). This law and its corresponding forest practices rules (FP rules) (Washington Administrative Code [WAC], Title 222) regulate forestry activities on state and private lands in Washington State and are designed to both protect public resources on forestland and ensure that Washington continues to support a viable forest products industry. (WAC 222-16-010 [Public Resources]) Public resources are defined as water, fish, wildlife, and capital improvements of the state or its political subdivisions. The FP Act created the Forest Practices Board (the Board), an independent state agency with 13 members. The Board, working with the public, stakeholder groups, and DNR, adopts FP rules and approves technical guidance (Forest Practices Board Manual) that assists

landowners in implementing FP rules. The FP rules are administered by DNR (with input and consultation from other entities where directed in the rule).

A flexible Forest Practices Program (FP Program) was developed to implement the FP Act and rules, because knowledge and understanding of natural systems evolves and natural systems change over time. A flexible FP Program is essential for meeting the intent of the FP Act in an arena where change is expected and ongoing. Components that provide systematic feedback and facilitate change when needed have been intentionally designed and incorporated into the FP Program. These components include the Compliance Monitoring Program (CMP), the Adaptive Management Program (AMP), and the Forest Practices Training Program (FPTP). Other FP Program components that provide critical functions for implementing the FP Act and rules and that provide information to improve the FP Program include forest practices application (FPA) review and FPA compliance and enforcement. When these components provide feedback suggesting that change is needed to better meet the goals of the FP Act and rules, the Board can adopt new FP rules or guidance. Additionally, the FP Program may adjust its operational practices, within the bounds of the FP Act and rules, to create some of the desired changes. Since promulgation of the FP Act in 1974, the FP Program's flexible design has facilitated many changes to the FP rules and Board Manual as well as to the FP Program.

One such change was the incorporation of the Compliance Monitoring Program into the FP Program. The CMP was not part of the original FP Program established in 1974. The CMP was first formally proposed as an essential element in the 1999 Forests and Fish Report, a multistakeholder agreement that delineated acceptable measures to protect water quality and habitat for federally listed aquatic species and other riparian dependent species on private and state forestlands in Washington. The legislature enacted the Forests and Fish Report protection measures into law in 1999. As a result, compliance monitoring for forest practices became a legal requirement. The CMP was promulgated as part of the FP rules in 2001 when the Board adopted FP rules that reflected the protection measures in the Forests and Fish law.

Regarding compliance monitoring, WAC 222-08-160(4) states: "The department shall conduct compliance monitoring that addresses the following key question: 'Are forest practices being conducted in compliance with the rules?' The department shall provide statistically sound, biennial compliance audits and monitoring reports to the board for consideration and support of rule and guidance analysis. Compliance monitoring shall determine whether forest practices rules are being implemented on the ground. An infrastructure to support compliance will include adequate compliance monitoring, enforcement, training, education and budget."

When funding for the CMP was allocated by the legislature in 2006, DNR, along with other stakeholders, developed a compliance monitoring program design and implemented an initial sampling effort in the spring of that year. The CMP has completed annual compliance monitoring sampling every year since 2006. Additionally, the program has produced biennial reports starting with the 2006–2007 CMP Biennium Report showing results of field reviews, as directed by WAC 222-08-160(4), for consideration and support of rule and guidance analysis. All completed reports can be found on the CMP website: http://www.dnr.wa.gov/programs-and-services/forest-practices/rule-implementation.

The CMP is a key component of a feedback loop that intends to improve compliance with the FP rules that protect public resources and maintain a viable forestry industry in Washington State. When sampling results provide sufficient information regarding a need for change, CMP reports include suggestions for potential changes that could help the FP Program better achieve the goals of the FP Act and rules. See Section 9 for a list of recent changes that resulted from CMP feedback.

3.2 Compliance Monitoring Program

Program Staffing

The Compliance Monitoring Program is directed by the DNR Forest Practices assistant division manager for operations. The program staff includes a program manager and a field coordinator, along with funded participation of one full-time staff person each from the Department of Ecology and Department of Fish and Wildlife. Additional assistance is provided by tribal biologists and other forest practices staff.

Reports

Field sampling of completed FPAs occurs annually and findings are presented in a biennial report as required by WAC 222-08-160(4). In 2011, the commissioner of public lands requested that the FP Program also begin producing annual reports in the years that a biennial report is not required. This present report is an annual, or interim, CMP report and covers data samples collected during the 2014 field season (first year of the 2014–2015 biennium cycle). Sample sizes in an annual report are too small to provide the designed statistical precision, because the second half of the complete population sample is obtained in the second year of the biennium cycle. Consequently, with only half of the sample data represented, the findings, conclusions, and recommendations are limited in an annual report. The data from the 2014–2015 field seasons will be combined to produce the desired precision for statistical estimates and resulting comprehensive findings, conclusions, and recommendations reported in the 2014–2015 biennial report scheduled for 2016. Annual reports provide the current status of CMP sampling, allowing the CMP to report results from Emphasis Samples completed in the first year of the biennial cycle a year earlier than does a biennial report.

Forest Practices Activities and Prescriptions

Forest practices activities are operations such as timber harvest and forest road construction that are subject to FP rules. Prescriptions are groupings of similar rules that apply to a forest practices activity. FP rules are divided and grouped by like topic/application for monitoring purposes. For example, forest practices activity types such as road construction and timber harvest are evaluated based on options available for implementing a particular activity, such as the many options available for harvest in the riparian management zone (DFC1, DFC2, etc.); and forest practices activity types are evaluated based on the function/feature being protected, such as water quality. In CMP reports, these rule groupings are called “prescription types.” The CMP obtains data from samples and reports compliance monitoring findings by prescription type.

These prescription types allow for statistical estimation of compliance with specific rule groups rather than an overall forest practices compliance rate. This enhances the ability to determine where additional training, education, or FP compliance efforts might be needed to increase landowner compliance with FP rules. The CMP, with stakeholder input, determines which FP rule prescription types will be sampled each year and then estimates the number of samples required for statistical precision. This number of samples is then visited by the compliance monitoring field team for each of the FP rule prescription types.

Compliance

Each FPA is observed for compliance with 2 elements: first, how well the conditions on the ground — after completion of forest management activities — meet FP rules; and second, how well the conditions on the ground — after completion of forest management activities — meet what the applicant stated on the FPA. The first is called "rule compliance" and the second is called "FPA compliance." The compliance monitoring field team has found that deviation on a particular FPA can occur in one of the following 3 ways:

1) The conditions on the ground are in compliance with FP rules but not with the FPA. For example, a landowner/applicant states on the FPA that he or she will leave an RMZ along the entire 1000-foot length of the Np stream in the harvest area, but upon completion of harvest the landowner leaves a buffer along 700 feet of the stream length. The 700-foot RMZ buffer is still in compliance with FP rules because the FP rules do not require the entire length of an Np stream to be buffered. However, the 700-foot buffer is not in compliance with what the landowner stated would be done on the FPA.
2) The conditions on the ground are in compliance with the FPA but deviate from the FP rules. For example, a landowner/applicant incorrectly measures the width of the stream in the FPA area and states on the FPA that the stream falls into a smaller (incorrect) width category that requires less protection. Subsequently, if the landowner implements the forest practices activity using the incorrect protection measures, the forest practice has deviated from FP rules but is in compliance with what the landowner stated on the FPA.
3) The conditions on the ground deviate from both the FP rules and the FPA.

The primary intent of the CMP is to determine on-the-ground compliance with FP rules, or "rule compliance." However, understanding deviation from the FPA, or "FPA compliance," can help DNR determine whether improvements should be made in application forms, application instructions, or other methods of landowner outreach and education. Information regarding both types of deviation helps to inform the efforts of the FP Program, improving compliance with FP rules.

Compliance Monitoring Scope Limitations

Compliance monitoring is limited by mandate, budget, and staffing, which results in a focused program with a well-defined yet limited scope. Compliance monitoring does not involve the following:

- Focus on individual landowners and compliance specific to those landowners, but rather focuses on 2 overall groups: small and large forest landowners.
- Focus on individual regions and compliance specific to that region, but rather focuses on statewide FP rules and FPAs.
- Track FP rule violations. When field reviewers encounter rule violations, the appropriate DNR regional staff is notified for further action.
- Modify water types. Field reviewers do, however, record observed differences between water type documentation on FPAs and on-the-ground physical features. See Section 3.1.

3.3 Forest Practices Rules

Overall, FP rules provide protection for many riparian and upland species and their forest habitat, as well as protection for water quality. Currently, compliance monitoring focuses on rules that protect aquatic and riparian species habitat. FP rules that help protect aquatic and riparian species habitat include rules regarding the following:

- Riparian protection
- Wetland protection
- Water typing
- Road construction, maintenance, and abandonment near water
- Harvest or road construction on unstable slopes

Budget and staffing preclude the ability to monitor with statistical precision all FP rules that might affect aquatic and riparian species habitat, as well as upland habitat. The CMP prioritizes rule sampling based on a forest practices activity's potential to impact public resources.

The following are the CMP's prioritized rules chosen for sampling during the 2014 field season.

Standard Sample

Certain specific FP rule groups are sampled every year and are considered to be part of the CMP Standard Sample. These include the following:

- Riparian rules — Western Washington and Eastern Washington RMZ rules (WAC 222-30-021 and 022)
- Road construction and maintenance rules (WAC 222-24)
- Wetland rules (WAC 222-30-020[6] and [7]; and WAC 222-24-015)
- Haul routes (WAC 222-24) for sediment delivery

Emphasis Sample

Other FP rule groups are sampled, as necessary, and are considered to be Emphasis Samples. These other FP rule groups govern activities utilized less often than the rules sampled in the Standard Sample. The smaller population size usually leads to the CMP sampling a higher proportion of the total emphasis population than is sampled in Standard Samples.

Note: Due in part to the CMP study redesign and staffing changes, there is no Emphasis Sample for the 2014 reporting period.

4. Compliance Monitoring Design and Methodology

Compliance monitoring design was developed to be a consistent and repeatable field-based method to determine if forest practices are conducted in compliance with forest practices rules (FP rules). Compliance monitoring design details are found in the document *Washington State Department of Natural Resources Forest Practices Compliance Monitoring Program Design and Compliance Monitoring Protocols*. Section 2 explains key design and methodology concepts used in the forest practices Compliance Monitoring Program.

4.1 Population and Sample Selection

The population designated for sampling consists of prescriptions identified on forest practices applications that have completed forest practices activities and expire April 1, 2014, through March 31, 2015. Each application states all of the forest practices activities that the landowner intends to implement. This information allows the compliance monitoring field team to locate forest practices applications (FPAs) that list the particular FP rule prescriptions being sampled in a given year. Sample selections for each prescription type are drawn from the FPAs that contain the prescriptions being monitored that year.

Landowner Population Groups

Compliance Monitoring Program (CMP) reports provide riparian and road compliance findings separately for small forest landowners and large forest landowners, in addition to findings for all landowners combined. To date, sample sizes for small forest landowners have been too small to achieve sufficient statistical precision for conclusions regarding small forest landowners as a separate landowner group.

Sample Selection

Populations are grouped by prescriptions (DFC1, DFC2, NIZH, etc.) that have been identified by completed individual FPAs to more accurately analyze the collected field data. Therefore, populations are determined by the frequency of prescriptions that occur as part of completed FPAs.

There are thousands of active (not yet expired) FPAs every year, because the majority of FPAs have 3 years in which to be completed. Each FPA has an expiration date. For the current report, to ensure that all active FPAs had an opportunity to be selected, the populations to be sampled are those FPAs that expire between April 1 of the preceding year and March 31 of the sampling year. For the 2014 sample, this included 2,797 FPAs (including forest practices notifications; see Glossary). Using the April 1 to March 31 window improves the likelihood that the forest practices operations are complete prior to the primary compliance monitoring sampling months, February through November, and that the compliance monitoring field team attempts to visit the site before the FPA expires.

To provide a random selection of FPAs from the sampling population, the FPAs that expire between April 1 and March 31 are assigned a random number as a decimal fraction between 0 and 1 and then are ordered from the smallest to the largest number. The selection methodology involves reviewing the FPAs in this random order. Each FPA is reviewed to determine the sample FP rule prescription types being sampled. This selection process continues through the ordered list of FPAs until the target population/sample size is reached for each prescription type.

All FPAs in the population are ordered by the assigned generated random number and categorized by region. Division staff review FPAs in the random order assigned for monitored activities that are completed. Region staff determine if the activities identified in the FPA have been completed. FPAs that do not contain monitored activities and FPAs that are not complete are discarded from the population. Sample sizes are applied in proportion to statewide population size for each prescription type.

For each riparian prescription, the population to be sampled consists of FPAs containing that prescription. In some cases, a single FPA contains multiple implementations of the same riparian prescription type. If this is the case, 1 prescription implementation is randomly selected for assessment. Table 1 lists the Standard Sample prescriptions monitored in 2014.

For roads prescriptions, compliance with a single rule on a single FPA is the percentage of applications of that road rule that were compliant. Thus, for road rules only, compliance with a

single rule can be a number between 0 and 1. For example, if a single rule is applied 6 times on one FPA and is compliant 5 out of 6 times, the compliance is 0.833 instead of 0 or 1 for that road rule on that FPA. The remaining analysis is the same as for riparian prescriptions.

Table 1. 2014 Standard Sample Prescriptions Monitored

	Statewide	Western WA Only
Roads	Road Construction and Abandonment	
	Haul Routes	
Harvest	RMZ — Type Ns Prescriptions	
	RMZ — Type Np Prescriptions	
	Wetlands (Type A&B and Forested)	RMZ — Type S or F Inner Zone Harvest DFC1
	RMZ — Type S or F No Inner Zone Harvest	RMZ — Type S or F Inner Zone Harvest DFC2

Sample Size and Confidence Values

Standard Sample

In the biennial compliance monitoring design used by the CMP, the Standard Sample uses a significance level of 95%. The CMP set a desired half-width of the 95% confidence interval (CI) at 6%. These choices reflect the CMP's intent to obtain the highest level of confidence that could be obtained with current resources. A 95% CI at +/– 6% means that if the sample was repeated 20 times, one would expect the population mean (the "true" compliance rate) to lie within the confidence interval 19 out of 20 times. The CMP sets the sample size to provide an approximate +/– 6% CI for the average compliance rate of each prescription type sampled for the biennium. This sample size is an estimate based on assuming that the variance in compliance rates and average number of applicable rules within each prescription is similar to historical observations. The population of FPAs in any given year is finite. Therefore, the size of the population impacts the variance of compliance rates and, by extension, the width of CIs and the estimated sample sizes. Thus, infrequent prescriptions may need fewer samples to attain the desired precision levels. Estimated population sizes for each prescription are used in the sample size estimation to estimate a "finite population correction factor." This means that a smaller sample is required than would be for an infinite population. See Appendix A for more information.

For this annual report, variance and cluster size (number of rules per prescription) were estimated based on the sample values from 4 years of data (2010–2013) prior to the 2014 sampling. Based on these data and the estimated FPA population size for the biennium, sample sizes were set for the biennium, and 40% of this sample size was applied to 2014. Only 40% of the biennial sample was completed in 2014 due to staffing limitations. The sample sizes were set based on an estimate of the sample sizes required to attain a width of +/– 6% for a 95% CI for

the combined 2014–2015 sample. The CI for this estimation was formed by assuming an approximate normal distribution for the average compliance ratio, so the half-width of a 95% CI is the estimated standard error multiplied by an appropriate t-statistic (approximately 2).

The CMP updated variance estimates prior to 2015 sampling using 2014 results, due to the population values varying widely among biennia. This 2-year approach assumes that there is no change in compliance between the 2 years, so that no bias is introduced by having unbalanced population sampling between the 2 years.

Sample sizes in an annual report, such as this one, are too small to provide precise statistical estimates. Observation and data collection is based on a 2-year sample population, with approximately half the samples observed in the first year and half the samples observed in the second year. Two years are needed to obtain enough samples to attain the desired level of statistical precision.

To reach the desired sample size, population sizes for each prescription type are estimated based on the proportion of the entire population viewed (Table 2). Total population sizes for prescription types are estimated, because it would take many currently unavailable hours for staff to review each of the 2,797 FPAs to find the exact population count for each prescription type. See Appendix A for more information regarding statistical methodologies.

Table 2. 2014 Standard Sample Count by Prescription Type

Geographic Region	Prescription Type	Sample Count	Estimated Population Size of FPAs with the Prescription
Statewide	Road Construction and Abandonment	6	591
	Haul Routes	20	n/a*
	RMZ — Type Ns Prescriptions	14	356
	RMZ — Type Np Prescriptions	14	322
	Type A Wetlands	15	53
	Type B Wetlands	10	105
	Forested Wetlands	8	104
	RMZ — Type S or F No Inner Zone Harvest	10	264
Western WA	RMZ — Type S or F Inner Zone Harvest DFC1	8	18
	RMZ — Type S or F Inner Zone Harvest DFC2	6	49

*The Haul Routes prescription does not have an estimated population.

In some cases the actual sample size did not match the planned sample size for the year. The 2 primary reasons for this discrepancy are 1) occasional loss of samples because sites were disqualified for a particular prescription after field inspection; and 2) correction to population size estimates, which reduced the number of samples necessary for adequate 2-year statistical precision. The compliance monitoring biennial sample design allows the program to compensate for any inadequacies in 2014 sample sizes by increasing samples to be observed in the upcoming 2015 field season. It is anticipated that sample sizes for the 2014 and 2015 field seasons together will provide the desired statistical precision for the 2014–2015 biennial report.

4.2 Field Review and Data Collection

The compliance monitoring field team uses 2 primary data collection methods of field observations and field measurements. These 2 methods determine whether the landowner/applicant met the requirements of FP rules while implementing forest practices activities. Field observations are visual assessments that help provide answers to the questions asked on CMP Field Forms. Specific measurements are taken to determine attributes such as tree/stump counts, RMZ length, RMZ width, and bankfull width. Examples of types of field observations and field measurements follow.

Riparian Harvest

- Observations:
  - Presence of alluvial fans, headwall seeps, and springs
  - Location of uppermost point of perennial flow
  - Presence of unstable slopes

- Measurements:
  - Bankfull width (BFW) — Measured for Type S, F, and N waters, except where the stream obviously exceeds or is below a threshold width (i.e., under or over 10 feet in Western Washington; under or over 15 feet in Eastern Washington). The channel width is measured (using a tape measure) at even intervals along the stream reach within the boundaries of the FPA. The goal is to obtain a minimum of 10 measurements, but if the stream reach is 300 feet or less, a measurement interval of 25 feet is used.
  - Stream length — Measured using a hip chain. The length is used to determine the intervals for BFW measurements and RMZ width measurements.
  - RMZ and WMZ widths — RMZ widths (and the 3 zones within the RMZ) and WMZ widths are measured using a laser hypsometer to ensure accurate horizontal distances. Lasers with reflectors (held in place) are used to ensure measurement precision. RMZ widths are marked with flagging for visual reference.

Road Construction and Abandonment and Haul Route Assessment

The assessment of road construction and abandonment is based on answering a series of questions found on the CMP Roads Field Form. The questions address observed site conditions based on the required management practices in FP rules (WAC 222-24-010, 020, 030, and 040).

The assessment of haul routes is based on observation of fulfillment of road rule requirements and on professional judgment from CMP participants, used to rate sediment delivery levels resulting from each haul route.

4.3 Compliance Assessment and Ratings

The CMP utilizes average compliance for a prescription among FPAs rather than the proportion of completely compliant FPAs. Each FPA is analyzed as a cluster of rules within each prescription. FPAs are then grouped according to relevant riparian prescriptions or road activities. Haul Routes, Roads, No Inner Zone Harvest (NIZH), Desired Future Condition Option 1 (DFC1), Desired Future Condition Option 2 (DFC2), Non-Fish-Bearing Perennial Waters, Non-Fish-Bearing Seasonal Waters, Type A&B Wetlands, and Forested Wetlands comprise the evaluated prescriptions. Compliance with individual rules is given a Bernoulli 0/1 result; the prescription is the sum of compliant rules divided by the sum of all rules applied across all FPAs. For example: If a prescription has 17 rules that apply to it (across all sampled FPAs), and 16 of those rules are implemented per rule requirements, then the average compliance for that prescription is 94% (16 compliant rules ÷ 17 total rules = 94%).

Compliant/Deviation Determination

Compliance percentages disseminated in CMP reports do not necessarily represent the complete picture of compliance with FP rules because there are varying levels of compliance that are difficult to quantify. The terminology describing compliance was changed to better recognize this issue. In past CMP reports, prescriptions have been described as Compliant or Noncompliant. Beginning with the 2012 report, prescriptions were considered Compliant with or a Deviation from FP rules. The former Noncompliant category has been relabeled Deviation to more accurately acknowledge that while a prescription as a whole may deviate from FP rules, several of the FP rules that comprise a prescription may be compliant. Section 1.2 of this report explains that a prescription is a grouping of FP rules. These groups were constructed by the CMP for the purposes of estimating compliance. The following example illustrates this concept.

The DFC2 prescription type (leaving trees closest to the water in Western Washington) is not a single FP rule but rather a grouping of several rules, some of which are listed below (WAC 22-30-021):

- Core zone — "No timber harvest or construction is allowed in the core zone."
- Inner zone — "Forest practices in the inner zone must be conducted in such a way as to meet or exceed stand requirements" (see Glossary). "Trees are selected for harvest starting from the outer most portion of the inner zone first."
- Outer zone — "Timber harvest in the outer zone must leave twenty riparian leave trees per acre." "Dispersal strategy-riparian leave trees, which means conifer species with a diameter measured at breast height (DBH) of twelve inches or greater, must be left dispersed approximately evenly throughout the outer zone."

These 6 rules are only a few of the FP rules that are part of the DFC2 prescription type. When the DFC2 prescription in a CMP report is shown with a compliance of 97.7%, this refers to the

average compliance of the sampled relevant rules within the DFC2 prescription. The corresponding Deviation category includes any FPAs that are a part of the DFC2 sample that deviated from at least 1 of the FP rules included in the prescription type.

It is important for decision makers to understand the meaning and severity of deviation from FP rules. To aid in this understanding, compliant and deviation assessments are assigned a compliance rating. Compliant prescriptions are rated either Compliant or Exceeds Rule Requirements. Prescriptions that deviate from FP rules are rated either Low, Moderate, High. When the compliance monitoring field team cannot determine the degree of deviation, it is rated Indeterminate. These ratings help to convey the level of deviation from what was required by the relevant rule.

Compliance Ratings Descriptions

This section describes 5 compliance ratings that are applied after the Compliant/Deviation assessment is made, as well as the Indeterminate rating. There are 2 categories for a Compliant assessment: Compliant and Exceeds Rule Requirements. There are 3 ratings for a Deviation assessment — Low, Moderate, High — as well as the Indeterminate rating.

Compliant Rating Determinations

The Compliant rating means that an activity meets the requirements of the individual FP rule that is relevant to that activity. By signing and submitting an FPA, a landowner is conveying the intention to conduct specific forest practices activities on lands with specific site characteristics as described on the FPA. The landowner's signature on the FPA acknowledges that the landowner understands that FP activities must comply with the FP Act and rules. It is important to note that these deviation ratings employ professional judgment and should not be used to excuse activities that violate FP rules or approved FPAs.

Implementing this system requires the following assumptions:

- All participants acknowledge that this process relies on professional judgment and does not represent determinations of rule effectiveness.
- There will be no statistical analysis beyond the narrow scope intended.

Compliant Ratings Definitions

- Compliant rating — The FP rule is compliant.
- Exceeds Rule Requirements (or Exceeds) rating — While implementing their forest practices activities, landowners/applicants sometimes choose to provide more protection than required by FP rules.

Deviation Rating Determinations

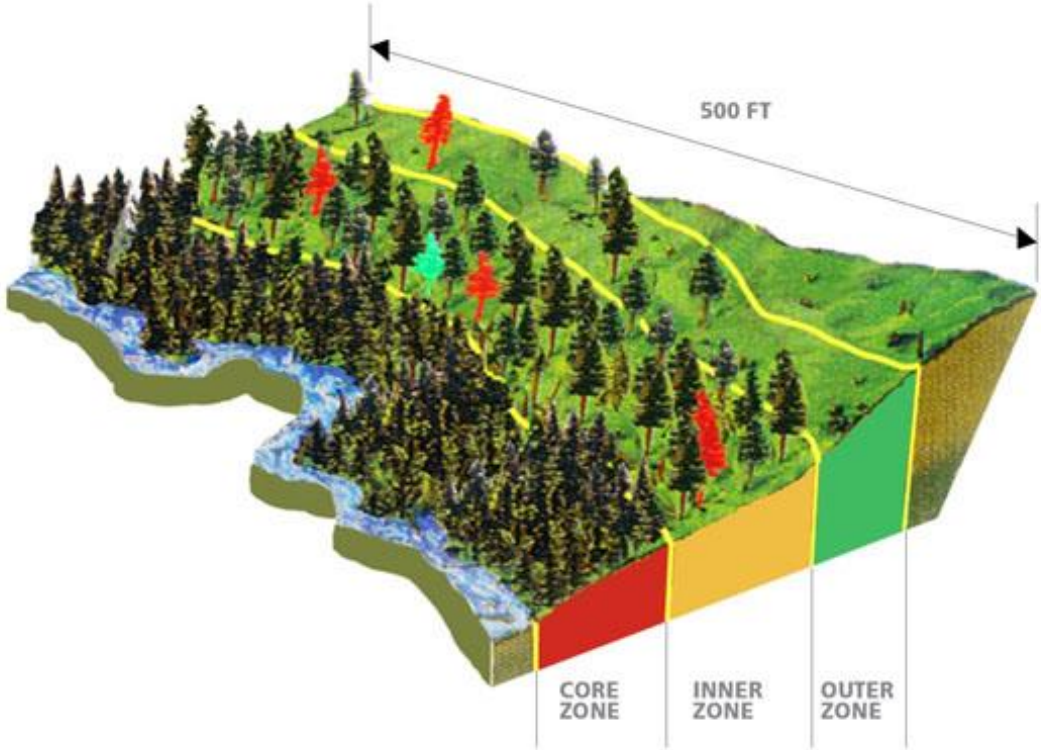
The Deviation rating means that an activity does not meet the requirements of the individual FP rule that is relevant to that activity. In order to gauge the magnitude of the deviation and where DNR might focus training efforts to improve compliance, the compliance monitoring field team uses professional judgment to rate deviations. There are 3 Deviation categories — Low, Moderate, High — as well as an Indeterminate rating. The following guidelines are used to assist professional judgment when rating the impact of deviation in the field:

- Low Deviation — Minor deviation from requirements of the rule
- Moderate Deviation — Moderate deviation from requirements of the rule
- High Deviation — Major deviation from requirements of the rule
- Indeterminate — The rule is out of compliance, but the compliance monitoring field team cannot determine the degree of deviation.

The following examples of deviations from FP rules illustrate that there can be a level of compliance for many of the rules included in a prescription type, even when they are assessed as a Deviation. The examples show the process of assigning ratings to the deviation.

Figure 1 illustrates a riparian harvest adjacent to Type F water assessed as a Deviation and rated as Low. A riparian zone harvest is subject to a number of complex FP rules. In this example, the landowner/applicant followed multiple FP rules by typing the stream accurately; measuring the stream width correctly; correctly measuring the core, inner, and outer zone widths; and leaving the core zone intact and harvesting the correct number and type of trees in the inner zone.

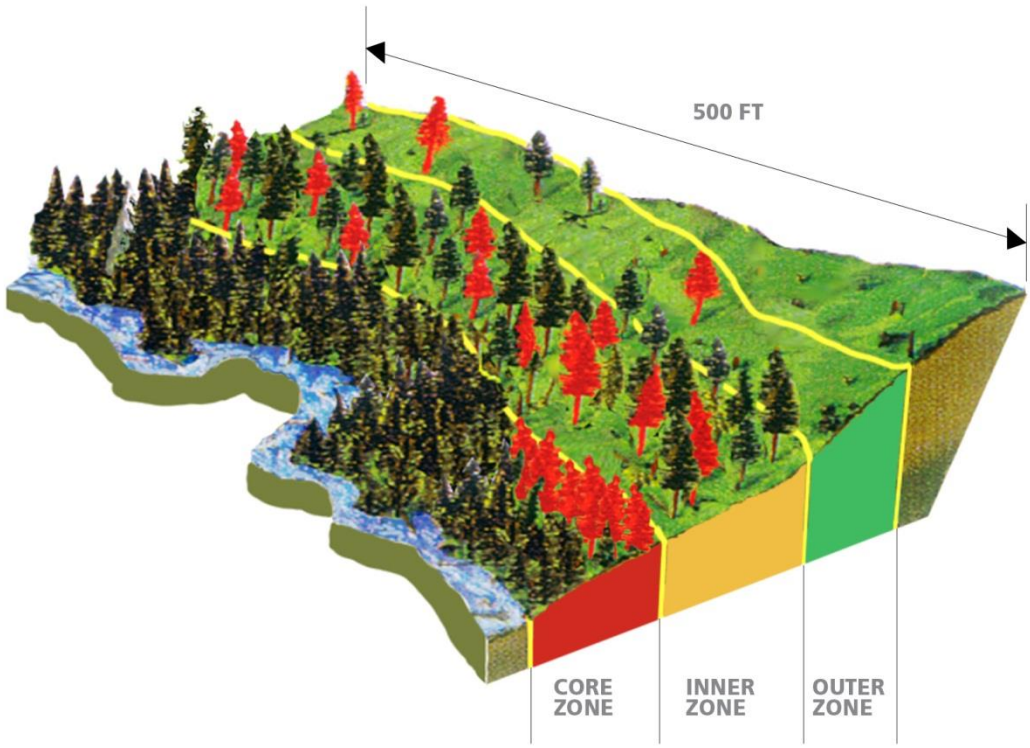
Figure 1. Inner Zone Harvest with Deviation Rated as Low



The red trees in the image represent trees that were required by rule to be left but were harvested. An offsetting factor in representing the average number of trees per acre required is that 1 tree per 500 feet was taken out of the outer zone, 3 trees too many were harvested from the inner zone, and an additional tree that had *not* been required to be left was left in the inner zone (represented in Figure 1 by the lime green tree outline).

In contrast, Figure 2 illustrates an example of inner zone harvest assessed as a Deviation and rated as High, on fish-bearing waters. In this scenario, the landowner/applicant planned a riparian zone harvest and followed the same FP rules as in the example above, except that harvest rules were not followed completely in any of the 3 zones. Each zone would be assessed for individual rule compliance. In this example, primarily core zone trees were harvested, as were many inner zone trees and outer zone trees that were required to be left.

Figure 2. Inner Zone Harvest with Deviation Rated as High



In Figure 2, 11 trees are missing per 500 feet of the inner zone and 3 trees are missing per 500 feet of the outer zone. Additionally, some harvest occurred in the core zone.

The expectation is for landowners to follow all relevant FP rules. However, there is more to evaluating compliance with FP rules than estimating average compliance for prescription types. The CMP continues to work toward finding better ways to report a more complete picture of compliance.

4.4 Design/Methodology Changes

Evaluation of Rule Compliance

An FPA contains a set of rule applications for a particular prescription. As part of the former study design, each FPA was evaluated as either compliant or not compliant for the prescription, based on 100% compliance with all rules in the prescription. The prescription compliance was the number of FPAs that were 100% compliant divided by the total number of FPAs containing the prescription. This can be viewed as a binomial proportion, and confidence intervals were formed under this assumption. This is statistically simple, but the sample sizes required for precise estimates of these proportions were difficult to attain, and there was concern about the pass/fail aspect of the compliance assessment.

The CMP has integrated a more quantitative estimate of compliance with each rule, with an increase of precision in the overall estimates. The sampling method remains cluster sampling. There are 2 levels of sampling units: the FPA and the rule application. The FPAs are clusters of rule prescriptions. In the previous method, only 1 assessment was made for each prescription per FPA, so the FPAs were all clusters of size 0 or 1, and the zeros dropped out of the population for the prescription. The changes made are to the methodology of assessing compliance with each prescription, rather than changes to the sampling design. These changes under the current sampling design amount to multiple applications of rules on single FPAs (i.e., the number of rules under prescription A on a single FPA = 0, 1, 2 … up to the total number of rules under prescription), so the FPAs are treated as clusters.

The purpose of the change is to estimate the *average* compliance for a prescription or rule group among FPAs rather than the proportion of completely compliant activities among FPAs. As discussed above, each FPA is a cluster of rule prescriptions, which can be grouped in various ways (prescription or rule group) or evaluated individually. If a single rule is of interest, the compliance proportion for that rule is a simple binomial proportion — FPAs that do not apply the rule drop out of the population. When groups of rules (or prescriptions) are of interest, all FPAs that contain at least 1 of the rules are part of the population (from a random sample). Multiple implementations on a single FPA are not independent, the FPA is a cluster sample, and each has a different number of rules. The mean or average compliance and the variance of the mean are calculated according to the rules of estimation for cluster samples (Cochran 1963; Scheaffer et al. 1990). Compliance rates will most likely be higher than the compliance rates previously estimated. For example, if there are many rules in a prescription, bad performance on a single rule will have very little effect on overall average compliance. On the other hand, compliance for each individual rule can be tracked separately, although precision will not be controlled for individual rule compliance.

Sample Size Estimation

The variance of the mean prescription compliance depends on the total number of FPAs that contain the prescription (the population size; because this is a finite population), the sampled number of FPAs that contain the prescription, the average number of prescription rules applied on each FPA, and the variability of compliance among FPAs. Data from 2010–2013 are used to estimate compliance variance for each prescription by year and to approximate sample sizes that should attain reasonable standard errors. Population sizes for each prescription are needed to approximate sample sizes. Because population sizes can vary from year to year, upper bounds for population sizes were used as initial estimates. When good estimates or census data are available before sampling is complete, the population sizes can be updated in the sample size estimation worksheet and the sample sizes can be adjusted. However, it is important to remember that the variance used for the sample size estimates is also only an estimate. There is no guarantee that the estimated confidence intervals will be the exact width that was projected.

4.5 Compliance Monitoring Challenges

Challenges are not uncommon for any complex assessment program. This section reviews current challenges for the CMP.

Sample and Measurement Error

Sampling error occurs when rule or Board Manual guidance specifies that average values are to be used during the layout of a specific prescription type. This is because averages vary depending on where measurements are taken. It is unlikely that the compliance monitoring field team can duplicate the exact same 10 measurements made along a stream reach for calculating stream width as were measured by a landowner. The result is that the compliance monitoring field team's average stream width value is likely different from the landowner's average stream width value. Statistical analysis techniques, such as a variability study to determine error tolerances, have not yet been pursued by CMP to help determine if a landowner's average measurement that differs slightly from the compliance monitoring field team's average measurement is considered the same or not (statistically speaking, "significantly different"). The CMP resolves the inability to determine statistical variability for average values by assigning an absolute 5% measurement error tolerance. This measurement error tolerance applies for only 2 specific measurements: when determining 1) leave tree to edge of bankfull width; or 2) buffer widths and lengths or floors within no-harvest RMZ areas. When a landowner's average value is within 5% of the compliance monitoring field team's average value, the landowner's values are considered accurate. If the landowner's average value falls outside the 5% error tolerance, the compliance monitoring field team value is assumed to be correct and the landowner's average value incorrect. The CMP employs a different approach to determine error tolerance for BFW measurements (Appendix B).

Variation in Natural Conditions

Natural systems such as forests are highly variable and difficult to measure with precision. Forest practices rules require precise measurements to implement forest practices activities. Applying precise measurements becomes difficult for forest practice activity implementation as well as for FPA compliance and compliance monitoring. When precise measurements required in the FP rules are confounded by variable site conditions, the CMP follows the most protective interpretation of the FP rules to determine compliance.

A frequent example of precise FP rules conflicting with imprecise on-site conditions occurs when a stream reach has FP rule–defined characteristics of both a Type Np stream and a Type F stream. Type Np streams are defined as streams that have a gradient greater than 20% and have perennial flow. Type F streams are defined as having a gradient equal to or less than 20%. When a stream reach meets the physical criteria for a Type F stream, and lies upstream of a portion of a stream reach that has a gradient greater than 20%, the stream is considered Type F. The only exception is when an approved Water Type Modification Form or supporting Interdisciplinary Team documentation has been submitted endorsing the change of the water type.

5. Forest Practices Rule Compliance for Water Types and Riparian, Wetland, and Equipment Limitation Zones

Forest practices rules (FP rules) are designed to protect aquatic resources and related habitat adjacent to typed waters and wetlands when forest practices activities are proposed. Riparian and wetland areas provide fish, amphibian, and wildlife habitat and protect water quality. A riparian management zone (RMZ) is the area adjacent to Types S, F or Np streams (see definitions below) where trees are retained to provide functions required by aquatic and riparian species and for protection from disturbance. A wetland management zone (WMZ) is the area located around the perimeter of a wetland where trees are left to provide protection from disturbance, as well as shade and nutrients for the wetland. Both RMZ and WMZ buffers filter runoff to minimize sediment entering water; provide long-term large woody debris recruitment and organic material crucial for fish and amphibian habitat; maintain shade to help regulate stream temperatures; and provide amphibian and wildlife habitat. Protection on Type Np and Ns streams also includes an equipment limitation zone (ELZ). This is a 30-foot-wide zone adjacent to Type Np and Ns streams. There are limitations on equipment use within the ELZ, and on-site mitigation measures are required if activities expose the soil on more than 10% of the zone.

FP rule protection measures that guide timber harvest options within RMZs depend on the water type (Type S, F, Np, Ns), width of the stream (bankfull width), and the site class (I, II, III, IV, V) of the RMZ. Wetland protection depends on the type and size of the wetland.

Section 3 provides FP rule and on-site review descriptions and compliance monitoring findings for the following within the Standard Sample:

- Water type observations
- Western Washington RMZs
- Eastern Washington RMZs
- Statewide wetlands

While maintaining adequate shade is an important part of riparian prescriptions, the forest practices shade rules are not yet part of the FP rules being monitored. Consequently, the riparian descriptions throughout the remainder of this report do not include shade, even though shade is integral to the overall protection provided in riparian areas. The CMP will initiate sampling for shade compliance after the program has methods suitable to produce relevant information.

Findings are limited in this report (and all annual reports) because sample sizes are smaller, representing less than half of the biennial sample. Caution must be taken when attempting to draw meaningful conclusions from the results provided in an annual report. The data and findings reported here may or may not be an indicator for upcoming findings that will be provided when both the 2014 and 2015 field season data are combined and reported in the 2014–2015 biennial report scheduled for 2016. The CMP is offering the following compliance monitoring findings primarily as a status update of CMP sampling.

5.1 Statewide Water Type Observations

In the initial years of compliance monitoring, compliance monitoring field team observations indicated that at times water types observed on the ground did not match water type classifications provided on submitted and approved forest practices applications (FPAs). This led to a concern regarding consistency and accuracy of water type information on FPAs, because the width and length of riparian buffers required under FP rules are directly linked to water type. In the FP rules, water is classified in specific stream and wetland categories, or "types," based on several factors (WAC 222-16-030, 031, and 035). Stream and wetland type classification is a fundamental aspect of determining which FP rules apply to forest management activities taking place adjacent to typed water. Specific FP rules apply to specific water types because different water types fulfill unique and cumulative functions for aquatic and riparian species and water quality. Waters of the state were initially classified by type using local knowledge and orthophotos and were represented on a set of water type maps. Currently, the public can find information about the water type assigned to a particular stream on the FPARS mapping site: http://www.dnr.wa.gov/programs-and-services/forest-practices/forest-practices-application-review-system-fpars. Because waters depicted on DNR water type maps were originally typed without a field visit, the maps can display incorrect water types and must be field verified prior to FPA approval.

FP Rules for Water Type

Forest practices water typing rules define 4 types of streams (S, F, Np, and Ns) and 3 types of wetlands (forested, nonforested Type A [including bogs], and nonforested Type B). The 4 types of streams are classified hierarchically based on stream function and level of protection required for the stream. The following are the stream types in hierarchical order starting with the highest level (requiring the most protection):

- Type S streams — The highest level of classification, "Shorelines" of the state as designated by the Department of Ecology.
- Type F streams — The second highest level of classification, with fish or specifically defined human uses or both.
- Type Np streams — The next lowest classification in the stream hierarchy, these are non-fish-bearing streams that have a perennial flow of water year-round during a normal rainfall year and include intermittent dry portions of the perennial channel.
- Type Ns streams — The lowest level of classified streams, seasonal non-fish-bearing streams where surface flow is not present year-round.

Wetlands are classified into 2 broad categories: Forested and Nonforested. Nonforested Wetlands are further divided into Type A and Type B.

- Forested Wetlands — Wetlands that have a crown closure of 30% or more (see Glossary).
- Nonforested Wetlands — Wetlands that have a crown closure of less than 30%.
    - Type A Wetlands — Greater than 0.5 acre in size and associated with at least 0.5 acre of ponded or standing open water present for at least 7 consecutive days between April 1 and October 1.
    - Type B Wetlands — All other nonforested wetlands greater than 0.25 acre.

On-site Review for Statewide Water Types

Field observations sometimes indicate that water types depicted on water type maps are incorrect. Landowners may use existing DNR water type maps as a starting point for information as they prepare their FPA for submittal to DNR, but must verify water types located within the areas proposed for forest management activities and indicate the correct water types on the FPA. Correct and accurate water typing is critical. When water is typed incorrectly, inadequate riparian protection measures may be applied, which may ultimately impact public resources. Water type verification occurs through measurement of the water's physical characteristics as defined in WAC 222-16-031 and 035, or through a protocol (fish) survey (to confirm fish presence/absence) as specified in Forest Practices Board Manual, Section 13. Applicants are encouraged but not required to complete water type classification worksheets or protocol surveys and submit them with their FPA as supporting documentation for the water types indicated on the FPA.

Changes to DNR water type maps can be made when data from field observations indicate that the water type on the water type map is incorrect and/or if a stream is found on the ground in a different location than depicted on the map or not at all. To propose a permanent water type

change from the water type indicated on the DNR water type map, an individual submits a Water Type Modification Form to DNR. The Water Type Modification Form goes through a concurrence process that provides opportunity for review by several stakeholder groups.

The compliance monitoring field team observes physical criteria (such as stream width, stream gradient, etc.) to determine if there appear to be differences between water types recorded on FPAs and what is observed on the ground. These observations are made on randomly selected stream reaches and wetlands within the FPA areas that have been previously randomly selected for compliance monitoring for other rules that year. The compliance monitoring field team evaluates only the stream reach or wetland within the proposed boundary shown on the FPA; therefore, the information is not sufficiently comprehensive to determine all water types, depending on the length and location of the water within the FPA. Water types can sometimes only be determined by continuing to observe and measure beyond the FPA harvest unit boundary.

The CMP developed the Supplemental Water Information Form (SWIF), used specifically for the purpose of recording potential water type discrepancies and other water related discrepancies. A SWIF is completed when potential inconsistencies are found by the compliance monitoring field team between on-the-ground measurements and observations and what is described in the FPA. The information is reported in the compliance monitoring report. If an FP rule violation occurred because of the water type inaccuracy observed (i.e., the water did not receive enough riparian protection — buffer width and length), then the information relating to the violation is sent to the appropriate DNR region for follow up. The intent of using SWIFs is to obtain a sense of both the overall magnitude of possible water typing discrepancies on the landscape and the incorrect implementation of riparian buffers designed to protect aquatic resources. The compliance monitoring field team does not engage in formal water typing (e.g., fish protocol surveys) with the intent of changing water types, because that action has a defined process beyond the scope of the compliance review. The burden is on the landowner to ensure that the water types on the FPA have in fact been field validated.

Findings for Statewide Water Types

Water types recorded on a SWIF are further broken down into waters correctly classified, underclassified, overclassified, and indeterminate. The latter 3 categories are defined as follows:

- Underclassified — Physical characteristics indicate that the water should have been typed on the FPA and protected on the ground at a higher level of the hierarchical water typing system. For example, the FPA depicts a Type Np water that after observation is found to be a Type F stream.
- Overclassified — Physical characteristics indicate that the water should have been typed on the FPA and protected on the ground at a lower level of the hierarchical water typing continuum. For example, the FPA depicts a Type F water that after observation is found to actually be a Type Np stream.
- Indeterminate — Waters for which the compliance monitoring field team determines there is not enough information to make a water typing determination. For example, when the compliance monitoring field team visits a site in the wettest part of the year

(winter) and cannot determine if the water would flow in the driest part of the year (summer), the compliance monitoring field team cannot determine with certainty if the water is a Type Np (perennial) or Ns (seasonal).

Table 3. 2014 Water Typing Observation Information

Water Type on FPA	# Waters in Standard Sample	# Waters Recorded on SWIF	SWIF # Waters Underclassified	SWIF # Waters Overclassified	SWIF # Waters Indeterminate
F or S	24	0	*	0	0
Ns	14	5	1	3	1
Np	14	0	0	0	0
Type A Wetlands	6	4	2	1	1
Type B Wetlands	8	2	0	1	1
Forested Wetlands	9	1	1	0	0
Total	75	12	4	5	3

*Compliance Monitoring field protocols stipulate that F or S waters are not to be evaluated for underclassification.

Of the 75 sampled waters for this annual report, 12 samples called for SWIFs due to water typing discrepancies. Four samples were underclassified, resulting in an underclassification rate of roughly 8%. Of the 4 underclassified waters, 3 were wetlands where fish presence was observed. The other underclassified water was typed as Ns, but water flow was observed during the compliance monitoring field visit in September. Five samples were overclassified. The overclassified waters were typically typed as Ns waters and were observed to be nonexistent during the compliance monitoring field visit. Three samples were indeterminate. Two of the indeterminate observations were for wetlands. Bog indicators were observed by the compliance monitoring field team for a sampled Type B wetland. However, due to physical sampling limitations, a final water typing determination was not possible. (See Table 3.)

Additionally, 2 SWIFs were completed for non–water typing issues. A SWIF was filled out when the compliance monitoring field team observed a channel migration zone that was unreported on the accompanying application. Rule compliance was unaffected due to an excessively large no-cut buffer left by the landowner. In addition, a SWIF was completed for an overstated stream size (by the applicant) on a Type F water (stream was less than 10 feet wide).

5.2 Statewide Summary for FP Rule Compliance for RMZs, WMZs, and ELZs

Section 3.2 provides 2 summary tables: Table 4 lists the RMZ, WMZ, and ELZ prescriptions sampled in 2014; Table 5 shows statewide results for compliance with RMZ and WMZ FP rules. The data and findings for each prescription are discussed in Section 3.3 (Western Washington RMZs) and Section 3.4 (Statewide RMZs, WMZs, and ELZs).

Table 4. RMZ, WMZ, and ELZ Prescriptions Sampled in 2014

Western WA	Eastern WA	Statewide
RMZ — Option 1, Thinning from Below RMZ — Option 2, Leaving Trees Closest to Water	No sample unique to Eastern WA	WMZ — Wetlands RMZ — No Inner Zone Harvest ELZ — Type Ns & Np Activities RMZ — Type Np

Each prescription has a unique set of timber harvest requirements and includes the use of a corresponding set of protocols and questions to determine compliance status. FP rule prescriptions for Type F and N streams can be different for Eastern and Western Washington. However, samples were not separated by Eastern and Western Washington. Wetland rules are consistent for Eastern and Western Washington.

The reader should be aware that the reported results represent only the first year of a biennial sample. Therefore, confidence intervals in this report may be artificially wide (wider confidence intervals represents less confidence in the value) but are expected to narrow with additional sampling and completion of the analysis for the entire biennium. The small proportion of small forest landowner FPAs in Table 5 reflects the small proportion of total small forest landowner FPAs in the total FPA population that contain the prescriptions assessed.

Table 5. 2014 Compliance with FP Rules for Riparian and Wetland Harvest Prescriptions

		Western WA		Statewide					
	Status of Compliance	DFC1	DFC2	No Inner Zone Harvest	Np Activities	Ns Activities	Type A&B Wetlands	Forested Wetlands	Roads
Small Forest Landowners	# Compliant Rules	n/a	n/a	9	2	2	14	4	n/a
	# with Deviation	n/a	n/a	0	0	0	1	0	n/a
	% of Sample Compliant	n/a	n/a	100%	100%	100%	93%	100%	n/a
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	0	0	2	2	2	4	2	0
Large Forest Landowners	# Compliant Rules	53	42	37	56	22	40	12	29
	# with Deviation	3	1	4	1	1	0	1	1
	% of Sample Compliant	94.6%	97.7%	90%	98%	96%	100%	92%	95.7%
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	8	6	8	12	12	10	7	6
All Landowners	# Compliant	53	42	46	58	22	54	16	29
	# with Deviation	3	1	4	1	1	1	1	1
	% of Sample Compliant	94.6%	97.7%	92%	98%	96%	98%	94%	95.7%
	Confidence Interval	(90, 99)	(92, 100)	(78, 100)	(95, 100)	(87, 100)	(95, 100)	(80, 100)	(86, 100)
	Prescriptions Assessed	8	6	10	14	14	14	9	6

5.3 Western Washington RMZs

5.3.1 Western WA Type S and F Waters

Section 3.3.1 addresses Type S and F riparian prescriptions: DFC1, Thinning from Below; and DFC2, Leaving Trees Closest to the Water.

On-site Review for Western WA Type S and F Waters

During the compliance monitoring field review, there are questions on the Western Washington Riparian Field Forms common to all riparian harvest options for Type S and F waters, including the following:

- Is there any harvest within the core, inner, and outer zones?
- Is the site class (variable in determining inner zone width) consistent with DNR site class maps?
- Is the stream width (variable in determining inner zone width) the same as stated on the FPA? If not, does it impact the inner zone width?
- Are unstable slopes with the potential to deliver (sediment) bounded out of the harvest unit?

In addition to common questions relevant to all Type S and F water riparian prescriptions, specific Western Washington riparian prescription questions are asked on the Western Washington Riparian Field Forms that assesses the unique rules directed at individual harvest options.

5.3.1.1 Western WA Type S and F Waters — DFC1, Thinning from Below

Desired Future Condition Option 1 is available if DFC growth modeling results show an available surplus basal area that allows for harvest to take place in the inner zone. DFC calculations indicate if a forest stand meets basal area requirements, that is, if the stand is on a trajectory to meet the DFC of 325 square feet of basal area per acre at a stand age of 140 years. When DFC calculations indicate that harvest is allowed because the model projects that more basal area is available than needed to meet the target basal area in the FP rule, then the smallest diameter trees are allowed to be harvested, followed by the selective harvest of progressively larger trees until the surplus basal area limit has been reached (also referred to as "thinning from below"). This selection process is intended to establish a forest environment where the leave trees in the inner zone can grow larger in a shorter time and meet desired large wood, fish habitat, and water quality requirements more quickly. The widths of the inner zone and outer zone vary depending on the bankfull width of the stream and the site class. A minimum of 57 conifer trees per acre must be left in the inner zone. A minimum of 20 conifer trees per acre greater than 12 inches diameter breast height (DBH) must be retained in the outer zone. The leave trees in the outer zone may be dispersed evenly throughout the zone or clumped around sensitive features such as seeps, springs, and forested wetlands.

Findings for Western WA Type S and F Waters — DFC1, Thinning from Below

Desired Future Condition Option 1 is the most complex Type F prescription to implement in terms of the number of conditions to be met. It occurs relatively rarely in the population of FPAs. In the 2014 sample, 8 FPAs statewide chose DFC1 as the harvest option from a total population of 18 FPAs. The resulting DFC1 prescription sample size was 8, and a total of 56 rules were evaluated.

Table 6. 2014 Compliance Ratings for Western WA Type S and F Waters — DFC1, Thinning from Below

RMZ Prescription	FP Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds (part of Compliant)	Compliant	Low	Moderate	Major	Indeterminate
DFC1 (%)	3.5%	94.6%	5.4%	0%	0%	0%
DFC1 (Rule Count)	2	53	3	0	0	0

Sample size = 8

Fifty-three of the sampled 56 rules were compliant for the DFC1 prescription sample, resulting in a 94.6% compliance rate. Of the 8 sites sampled, 5 were 100% compliant and 3 showed deviation from at least 1 FP rule in the prescription type. Of the sites with a Low Deviation rating, 1 site had less than the required number of outer zone trees; 1 site had inner zone leave trees that did not meet the diameter requirements; and 1 site revealed harvest in the core zone. This third deviation, per the compliance monitoring field team notes, involved an unaccounted for meander in stream course that was approximately 10 feet wide. (See Table 6.)

5.3.1.2 Western WA Type S and F Waters — DFC2, Leaving Trees Closest to the Water

Desired Future Condition Option 2 only applies to RMZs in site classes I, II, and III on streams that are less than or equal to 10 feet wide and to RMZs in site classes I and II for streams greater than 10 feet wide. For this option, DFC growth modeling results show an available surplus basal area that allows for harvest to take place in the inner zone. Trees are selected for harvest starting from the outermost portion of the inner zone first and then progressively closer to the stream. Twenty conifer trees per acre with a minimum DBH of 12 inches must be left in the harvested area of the inner zone. The widths of the inner zone and outer zone vary depending on the bankfull width of the stream and the site class. For site classes I, II, and III on streams less than or equal to 10 feet, there is a 30-foot no-harvest extension beginning at the outer edge of the core zone. For site classes I and II on streams greater than 10 feet, there is a 50 foot no-harvest extension beginning at the outer edge of the core zone. Twenty conifer trees per acre greater than 12 inches DBH must be retained after harvest in the outer zone, unless a large woody debris in-channel placement strategy is selected. Leave trees in the outer zone may be evenly dispersed throughout the zone or clumped around sensitive features.

Findings for Western WA Type S and F Waters — DFC2, Leaving Trees Closest to the Water

Desired Future Condition Option 2 harvest is less complex to implement and is chosen more frequently than DFC1. In the 2014 sample, 6 DFC2 prescriptions were sampled from an estimated population of 49 FPAs. The resulting DFC2 prescription sample size was 6, and a total of 43 rules were evaluated.

Table 7. 2014 Compliance Ratings for Type S and F Waters in Western WA — DFC2, Leaving Trees Closest to the Water

RMZ Prescription	FP Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceed (part of Compliant)	Compliant	Low	Moderate	Major	Indeterminate
DFC2 (%)	18.6%	97.7%	2.3%	0%	0%	0%
DFC2 (Rule Count)	8	42	1	0	0	0

Sample size = 6

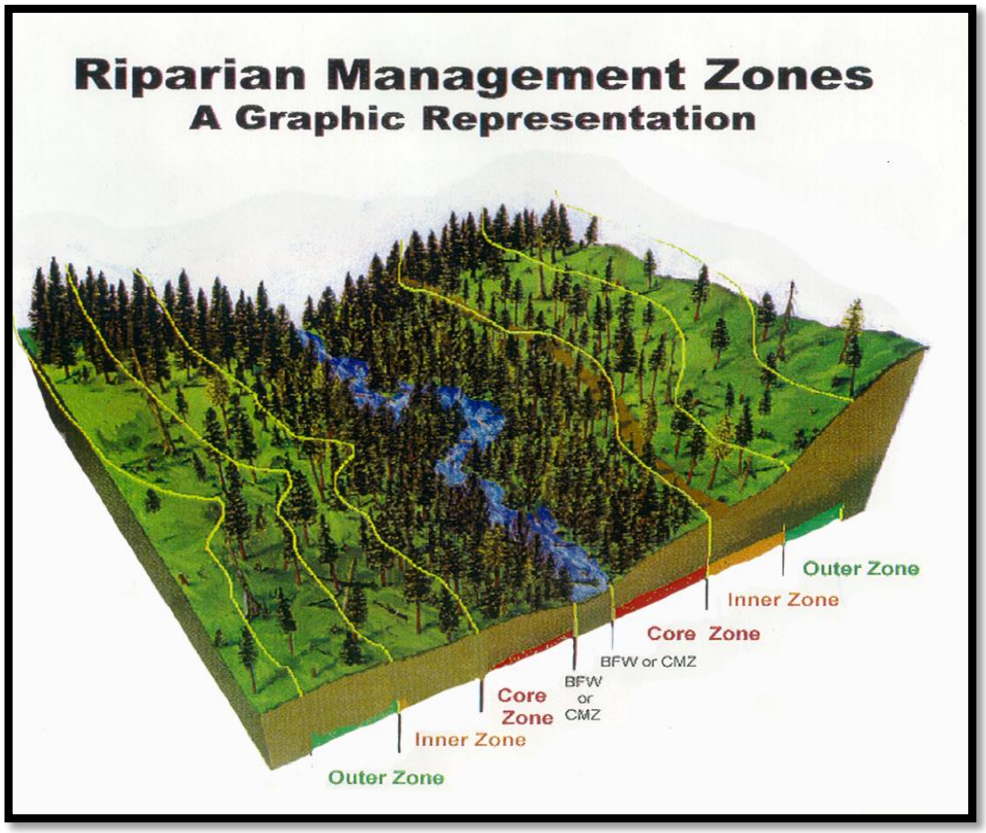
Forty-two of the sampled 43 rules were compliant for the DFC2 prescription sample, resulting in a 97.7% compliance rate. Of the 6 sites sampled, 5 were 100% compliant and 1 showed deviation from at least 1 FP rule in the prescription type. Harvest in the core zone was observed for the 1 sampled rule deviation; 3 harvested stumps were counted, resulting in a Low Deviation rating. All observed Exceeds ratings were the result of leaving more than the required amount of inner and outer zone leave trees. (See Table 7.)

5.4 Statewide RMZs, WMZs, and ELZs

Protection measures adjacent to typed water in the state of Washington include protecting channel migration zones (CMZs); establishing riparian management zones (RMZs) along the full length of fish-bearing waters and along a portion of the length of perennial non-fish-bearing waters; retaining no-harvest buffers adjacent to sensitive sites; and establishing equipment limitation zones (ELZs), where equipment is limited along non-fish-bearing waters. RMZs adjacent to fish-bearing streams include a core zone, inner zone, and outer zone, with differing prescriptions delineated in FP rules for inner and outer zones (see Figure 3).

In Western Washington, no timber harvest or road construction is allowed in the 50-foot core zone (zone closest to the water), except for the construction and maintenance of road crossings and the creation and use of yarding corridors. The inner zone (middle zone, not including core zone) ranges from 10 to 100 feet, depending on width of the stream and the site class (see Glossary) of the forested stand. Timber harvest of excess trees in the inner zone is only allowed if predetermined stand requirements are met, which are intended to result in a mature riparian forest stand at 140 years of age (called “desired future condition,” or DFC). Timber harvest is allowed in the outer zone (adjacent to and outside the inner zone), with 20 riparian leave trees per acre retained following harvest.

Figure 3. Type S and F Water RMZs



5.4.1 Statewide Typed Waters

Protection along non-fish-bearing waters in Western Washington includes RMZs along at least 50% of the length of Type Np waters and around sensitive sites, and the establishment of ELZs for both Np and Ns waters. An ELZ is a 30-foot-wide area where equipment use is restricted in order to minimize ground and soil disturbance. The ELZ protects stream bank integrity and helps minimize sediment delivery to non-fish-bearing waters that could potentially be routed farther downstream to fish-bearing waters.

In Eastern Washington, riparian management is intended to result in stand conditions that vary over time. Management is designed to mimic local disturbance (such as wildfire) regimes in a way that protects riparian function conditions and maintains general forest health. Harvest adjacent to a Type S, F, or Np stream is based on the DNR site class map, timber habitat type, basal area, and shade requirements needed to protect the stream. Habitat types include Ponderosa Pine, Mixed Conifer, and High Elevation. The no harvest core zone along type S and F waters is 30 feet. Harvest units within the Bull Trout Habitat Overlay must leave all available shade within 75 feet of the bankfull width or CMZ, depending on which is greater. Np and Ns waters have an ELZ of 30 feet.

5.4.1.1 Statewide Type S and F Waters — No Inner Zone Harvest

For the No Inner Zone Harvest (NIZH) option, DFC results show that existing stands in the combined core and inner zone do not meet stand requirements. Therefore, NIZH can take place, or sometimes the landowner elects not to harvest in the inner zone for operational or other reasons.

Findings for Statewide Type S and F Water — No Inner Zone Harvest

No Inner Zone Harvest is the most frequently selected harvest strategy adjacent to fish-bearing waters. This harvest strategy occurred on an estimated 264 FPAs in the 2014 population. The resulting NIZH prescription sample size was 10, and a total of 50 rules were evaluated.

Table 8. 2014 Compliance Ratings for Statewide Type S and F Waters — No Inner Zone Harvest

RMZ Prescription	FP Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds (part of Compliant)	Compliant	Low	Moderate	High	Indeterminate
No Inner Zone Harvest (%)	4%	92%	6%	0%	2%	0%
No Inner Zone Harvest (Rule Count)	2	46	3	0	1	0

Sample size = 10

Forty-six of the sampled 50 rules were compliant for the NIZH prescription sample, resulting in a 92% compliance rate. Of the 10 sites sampled, 8 were 100% compliant and 2 showed deviation from at least 1 FP rule in the prescription type. Of the 4 noncompliant rules recorded, 3 were rated Low Deviation because of incorrect site class, harvest in the inner zone, and a CMZ not reported on the FPA. Harvest was observed in the inner zone through the observation of 4 stumps. The fourth deviant observation was rated High Deviation due to an incorrect number of outer zone leave trees. No leave trees were observed in the outer zone, 10 leave trees were required. (See Table 8.)

The Exceeds ratings were recorded on 2 separate samples for the same rule. Additional outer zone leave trees were left beyond what was required by rule.

5.4.1.2 Statewide Type Np Waters

Type Np streams and sensitive sites contribute to the quality of water and fish habitat in downstream Type S and/or F streams. They also provide habitat for some wildlife.

Fifty-foot-wide RMZs are required along portions (and specified locations) of Type Np streams. For example, a 50-foot-wide no-harvest RMZ is required where Type Np streams join a Type S or F stream.

The total distance of the 50-foot buffer required along a Type Np stream varies and depends on the length of the Type Np stream from the confluence with the Type S or F stream. At least 50% of a Type Np water's length must be protected by buffers on both sides of the stream (2-sided buffers). If the Type Np water on the FPA is located more than 500 feet upstream from the confluence of a Type S or F water, and if the Type Np water is more than 1,000 feet in length, then the minimum percentage of the length of Type Np water to be buffered varies per the table in WAC 222-30-021(2)(b)(vii).

Sensitive sites associated with Type Np streams must also be protected with buffers or harvest restrictions. These include headwater springs or the uppermost point of perennial flow; the intersection

of 2 or more Type Np waters; perennially saturated side-slope seeps; perennially saturated headwall seeps; and alluvial fans. No harvest is allowed within alluvial fans.

Type Np streams also require a 30-foot-wide ELZ. Equipment use and other forest practices are specifically limited, and mitigation may be required if activities expose the soil on more than 10% of the ELZ length.

On-site Review for Statewide Type Np Waters

Questions asked on the Field Form for Type Np streams differ from those for Type S and F fish-bearing streams. Examples include the following:

- Is there evidence of equipment entry into the 30-foot ELZ? If so, was less than 10% of the soil within the ELZ exposed due to activities?
- Was the appropriate length of 50-foot no-harvest zone left on the given stream segment?

Findings for Statewide Type Np Waters

Type Np streams were commonly encountered with an estimated 322 FPAs having 1 or more Np streams within their harvest boundaries. The resulting Np prescription sample size was 14, and a total of 59 rules were evaluated.

Table 9. 2014 Compliance Ratings for Statewide Type Np Waters

RMZ Prescription	FP Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds (part of Compliant)	Compliant	Low	Moderate	High	Indeterminate
Np Water (%)	0%	98.3%	1.7%	0%	0%	0%
Np Water (Rule Count)	0	58	1	0	0	0

Sample size = 14

Fifty-eight of the sampled 59 rules were compliant for the Type Np prescription sample, resulting in a 97% compliance rate. Of the 14 sites sampled, 13 were 100% compliant and 1 showed deviation from at least 1 FP rule in the prescription type. The 1 noncompliant rule recorded was rated Low Deviation for an incorrect uppermost point of perennial flow location and confluence buffer. (See Table 9.)

5.4.1.3 Statewide Type Ns Waters

Buffers are not required for Type Ns streams. There is a 30-foot ELZ requirement, and mitigation measures are required if more than 10% of the soil in the ELZ is exposed.

Findings for Statewide Type Ns Waters

Type Ns waters are common, occurring in an estimated 356 FPAs in the statewide population for the 2014 sample. The resulting Ns prescription sample size was 14, and a total of 25 rules were evaluated.

Table 10. 2014 Compliance Ratings for Statewide Type Ns Waters

RMZ Prescription	Forest Practices Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds (part of Compliant)	Compliant	Low	Moderate	High	Indeterminate
Ns Water (%)	0%	96%	0%	0%	4%	4%
Ns Water (Rule Count)	0	24	0	0	1	1

Sample size = 14

Twenty-four of the sampled 25 rules were compliant for the Ns prescription sample, resulting in a 96% compliance rate. Of the 14 sites sampled, 13 were 100% compliant and 1 showed deviation from at least 1 FP rule in the prescription type. The 1 noncompliant rule recorded was the result of an incorrectly typed stream. The compliance monitoring team observed flowing water in the channel of a stream that had been typed Ns by the landowner. The observed discrepancy resulted in a rating of High Deviation. The 1 Indeterminate rating resulted from the landowner/applicant's wording on the FPA regarding water typing. (See Table 10.)

5.4.2 Statewide WMZs

Forest practices wetland rules are the same for Western and Eastern Washington. Wetland management zones have variable widths based on the size and type of wetland. Type A Wetlands greater than 5 acres have a minimum 50-foot WMZ width. Type A&B Wetlands of 0.5 to 5 acres have a minimum 25-foot WMZ width, while Type B Wetlands less than 0.5 acre and Forested Wetlands require no WMZ. Leave trees are required (by size and number) within the WMZ. There are no leave tree requirements for the Forested Wetlands type. Restrictions also apply regarding the maximum width of openings created by harvesting within the WMZ. Additionally, ground-based harvesting systems shall not be used within the minimum WMZ width without written approval from DNR.

On-site Review for Statewide Wetlands

Protection measures for wetlands depend on the size and type of wetland. The information collected by the compliance monitoring field team varies depending on the type of wetland. Only one of the questions answered by the team is applicable to all wetlands:

- Were the wetlands typed and sized appropriately on the ground and consistent with the FPA?

In addition, for Type A&B Wetlands, the compliance monitoring field team evaluates the following:

- Leave trees in the WMZ for species, number, and size
- Is the variable buffer width appropriate relative to the WMZ table in the rules?
- If operations were conducted within the WMZ, were the openings less than 100 feet wide?
- If operations were conducted within the WMZ, were the openings no closer than 200 feet from each other?

- Approval by DNR for use of ground-based harvesting systems within the minimum WMZ and for any timber that was felled into or cable yarded across the wetland
- Protections applied when a WMZ overlaps an RMZ
- For particular leave tree requirements, if the harvest within the WMZ is greater than or less than 10%

If harvest occurs within a forested wetland, the compliance monitoring field team determines whether the harvest method is limited to low impact harvest or cable systems; and whether the wetland boundaries (if greater than 3 acres within the harvest unit) are delineated correctly and shown on the activity map by the landowner/applicant.

5.4.2.1 Statewide Type A&B WMZs

Findings for Type A&B WMZs Statewide

Type A&B Wetlands are estimated to occur on 53 FPAs statewide in the 2014 population. The resulting Type A&B Wetlands prescription sample size was 14, and a total of 55 rules were evaluated.

Table 11. 2014 Compliance Ratings for Statewide Type A&B WMZs

WMZ Prescription	FP Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Low	Moderate	High	Indeterminate
Type A&B (%)	0%	98.2%	0%	0%	1.8%	1.8%
Type A&B (Rule Count)	0	54	0	0	1	1

Sample Size = 14

Fifty-four of the sampled 55 rules were compliant for the Type A&B WMZ sample, resulting in a 98.2% compliance rate. Of the 14 sites sampled, 13 were 100% compliant and 1 showed deviation from at least 1 FP rule in the prescription type. The 1 noncompliant rule recorded was the result of an incorrectly typed wetland. The selected Type A Wetland was determined to be associated with a fish-bearing lake. This typing discrepancy resulted in a rating of High Deviation. The 1 indeterminate rating was a result of a Type A Wetland being potentially associated with a fish-bearing lake. A final determination could not be ascertained due to seasonal water flow conditions, and the associated Type S water in question was located on another landowner's property. (See Table 11.)

5.4.2.2 Statewide Forested WMZs

Findings for Statewide Forested WMZs

Approximately 104 FPAs statewide contained Forested Wetlands in the 2014 sample population. The resulting Forested Wetlands prescription sample size was 8, and a total of 17 rules were evaluated.

Table 12. 2014 Compliance Ratings for Statewide Forested WMZs

WMZ Prescription	FP Rule Compliance Ratings					
	Compliant Ratings		Deviation Ratings			
	Exceeds	Compliant	Low	Moderate	High	Indeterminate
Forested (%)	17.6%	94.1%	0%	0%	5.9%	0%
Forested (Rule Count)	3	16	0	0	1	0

Sample size = 8

Sixteen of the sampled 17 rules were compliant for the forested WMZ sample, resulting in a 94.1% compliance rate. Of the 8 sites sampled, 7 were 100% compliant and 1 showed deviation from at least 1 FP rule in the prescription type. The 1 noncompliant rule recorded was the result of an incorrectly typed wetland. Fish presence was observed in the selected Forested Wetland, resulting in a rating of High Deviation. (See Table 12.)

6. Forest Practices Rule Compliance for Roads and Haul Routes

Section 4 provides rule and on-site review descriptions and compliance monitoring findings regarding the Standard Sample for roads and haul routes statewide.

Although Roads prescription sampling follows the same design as riparian sampling, Haul Routes prescription sampling is designed differently. Haul Routes sampling assesses each 0.1 mile segment of forest road for correct design and for construction or maintenance of roads to protect typed waters from sediment delivery. This strategy enables determination of the rate of compliance for the entire haul route specified on the FPA.

Findings are limited in this report (and all annual reports) due to smaller sample sizes that represent approximately half of the entire biennial sample. Caution must be taken when attempting to draw meaningful conclusions from the findings provided in this annual report. The data and findings shown here may or may not be an indicator for upcoming findings that will be provided when both the 2014 and 2015 field season data are combined and reported in the biennial report. The Compliance Monitoring Program offers the following data as a status update of CMP sampling.

A well-designed, located, constructed, and maintained system of forest roads is essential to both forest management and protection of public resources. Washington State forest practices rules — including those for road construction, maintenance, and abandonment and for “best management practices” — are

some of the most, if not the most, stringent in the country. The FP rules are designed to help ensure that forest roads are constructed, maintained, and abandoned to do the following:

- Provide for fish passage
- Prevent mass wasting
- Limit delivery of sediment and surface runoff to all typed waters
- Avoid capture and redirection of surface water or groundwater
- Divert road runoff to the forest floor
- Provide for the passage of some woody debris
- Protect stream bank stability
- Minimize construction of new roads
- Assure no net loss of wetland function

FP rules accomplish these goals through ensuring the proper location, design, construction, maintenance, and abandonment of forest roads, landings, and stream crossings.

The CMP collects data annually on sites where one or more of the following exists:

- Road construction
- Landing construction
- Type N stream road crossing construction, including fords
- Road abandonment
- Haul routes (forest roads used to truck timber to market)

FP Rules for Statewide Roads and Haul Routes

FP rules for road construction, landing construction, Type F and N stream road crossings, road abandonment, and haul routes are explained below.

Forest Road Construction

Road construction is composed of 3 components: road location, road design, and actual construction. The road rules require specific standards for road location, design, and construction, which are reflected in the questions found in the compliance monitoring Roads Field Form (defined in the on-site review section, below).

1) Road location — FP rules require that roads be located to fit the topography to minimize alteration of natural features (WAC 222-24-020). Examples of FP rule requirements related to road location are the requirement that the landowner/applicant minimize the number of stream crossings and not locate roads in bogs or within natural drainage channels (except for crossings).
2) Road design — FP rules include road design standards that address construction techniques and water management (WAC 222-24-020). For example, new road construction on side slopes exceeding 60% that have the potential to deliver sediment to any typed water or wetland need to utilize full bench construction techniques (WAC 222-24-020[8]).
3) Road construction — Road construction requirements focus on maintaining stable road prisms and water crossing structures, and on minimizing sediment delivery to surface waters and wetlands (WAC 222-24-030). For example, road construction requires that erodible soil

disturbed during road construction needs to be located where it could not reasonably be expected to enter the stream network or needs to be seeded with noninvasive plant species.

Landing Location and Construction

Landings are subject to several FP rules. Landings must not be located within specific areas such as natural drainage channels, RMZs, or WMZs. Landings must be constructed so that they are sloped to minimize accumulation of water on the landing. Excavation material shall not be sidecast where there is high potential for material to enter WMZs or within the bankfull width of any stream or the 100-year flood level of any typed water (WAC 222-24-035).

Type F and N Stream Crossings

Installation, maintenance, and removal of bridges, culverts, and temporary water crossings are subject to several FP rules and to Forest Practices Board Manual, Section 5. For example, culvert placement must be designed so that the alignment and slope of the culvert parallels the natural flow of the stream and so that placement does not cause scouring of the streambed and erosion of the stream banks in the vicinity of the project. Additionally, bridges must not constrict clearly defined channels, and temporary water crossings must be constructed to facilitate abandonment (WAC 222-24-040).

Road Abandonment

Landowners have the option to abandon forest roads, with the exception that in some watersheds landowners are required to abandon roads to keep the road ratio at a certain level. When a landowner chooses to abandon a forest road, specific standards delineated in the FP rules and Board Manual, Section 3, must be followed. For example, abandoned roads must be out-sloped, water barred, or otherwise left in a condition suitable to control erosion and maintain water movement within wetlands and natural drainages. An abandoned road must be blocked so that four-wheeled highway vehicles cannot pass the point of closure at the time of abandonment, and water crossing structures must be removed (WAC 222-24-052[3]).

Haul Routes

FP rules state that roads currently used or proposed to be used for timber hauling must be maintained in a condition that prevents potential or actual damage to public resources (WAC 222-24-051[12]). The compliance monitoring field team observes and records observations for haul routes regarding level of sediment delivery.

On-site Review for Statewide Roads and Haul Routes

In order to determine road compliance, the compliance monitoring field team visits FPA sites where forest road construction, landing construction, Type N stream road crossings, abandoned roads, and haul routes are present. The compliance monitoring field team uses the Roads Field Form and the Haul Route Field Form to record information onsite. The data recorded on the Roads Field Form and the Haul Route Field Form help the compliance monitoring field team determine road compliance for each FPA sampled.

Roads Field Form

The compliance monitoring field team uses the Roads Field Form to record data observed for forest road construction, landing construction, Type N stream road crossings, and abandoned roads. The initial series of questions on the Roads Field Form assesses road surface conditions, drainage structure placement and stabilization, routing of drainage water to the forest floor, and potential delivery of sidecast. Stream crossing questions assess stream crossing placement, frequency, culvert sizing, positioning, and stabilization. Other questions address wetland crossings, road location, wetland replacement, abandonment and stabilization of temporary roads, road abandonment, and proper construction and drainage for forest road landings.

The following are examples of questions found on the Roads Field Form:

- Road location — "Does new road construction minimize stream crossings?" (WAC 222-24-020[5])
- Road design — "Where the potential for sediment delivery existed, was full bench construction utilized for roads built on slopes greater than 60%?" (WAC 222-24-020[8])
- Road construction — "Were erodible soils disturbed during construction stabilized to prevent the potential to deliver to typed waters?" (WAC 222-24-030[4])
- Road landing location and construction — "Was the landing sloped to minimize accumulation of water on the landing?" (WAC 222-24-035) (Western WA only)
- Type N stream crossings — "Are the alignment and slope of all culverts on grade with the natural streambed? (WAC 222-24-040[2], [3], [4], and [5])
- Road abandonment — "Was the road blocked so that four-wheel highway vehicles cannot pass the point of closure at the time of abandonment?" (WAC 222-24-052)

Haul Route Field Form

The compliance monitoring field team uses the Haul Route Field Form to assess haul routes. The sampling method provides information for reporting the proportion of compliance/deviance, the level of sediment delivery (Table 13), and the cause of the noncompliance (Table 14).

There are 5 recorded levels of sediment delivery (No Delivery, De Minimis, Low, Medium, and High) used by the compliance monitoring field team for rating levels of sediment delivery, as well as 1 decision type (No Consensus). (See Table 13.)

Table 13. Haul Route Sediment Delivery Level Categories

Delivery Level	Delivery Level Description
No Delivery	Complete disconnection of sediment delivery to typed water. Considered compliant.
De Minimis	Overland flow from roads reaches typed waters, but sediment delivery is indeterminable from background levels of turbidity. Considered compliant.
Low	Low chronic or temporary delivery. Effects are observable at the site of entry (distance downstream less than 1 channel width) only are and not expected to magnify over time given the existing activity.
Medium	Measurable but noncritical levels of delivery. Visual plume at the reach scale.
High	Extensive or critical levels of delivery. Substantial violations of turbidity criteria or significant visual plumes that occupy the channel and go beyond the reach scale (for example, around multiple bends in a stream).
No Consensus	The observers do not agree on the classification. Comments are essential to determine the scope of the difference, recording each observer's classification and the basis of disagreement.

It is helpful, to determine, where possible, causes for sediment delivery. The compliance monitoring field team observes and records both primary and secondary causes of sediment delivery. (See Table 14.)

Table 14. Potential Causes of Sediment Delivery

Potential Causes	Cause Description
Faulty cross drainage	Inadequate frequency of or nonfunctioning drainage structures that carry road prism runoff or seepage, allowing sediment delivery to typed water
Inadequate water crossing structures	Absence of or nonfunctioning structures designed to pass typed water across a forest road, resulting in sediment delivery
Obstructed or bermed ditch line	Features of the road surface or ditch that divert water normally serviced by the ditch, causing sedimentation of typed water
Intercepted water	Water intercepted by road features and diverted to a channel other than its channel of origin prior to the road construction
Contaminated ditchwater	Ditchwater containing suspended sediment that flows into typed water
Ruts/inadequate crown	Perturbations of the road surface contributing sediments to runoff that reaches typed water
Driving in ditch line	Vehicular disturbance of stabilized ditches, resulting in sediment reaching typed water
Haul on native surface or inadequate rock	Road haul on a running surface containing fine particles that are captured by runoff and contributed as sediment to typed water
Water channeled to eroded/failing slopes	Water flow or runoff across unstabilized road features that contributes sediment to typed water
Road fill failure	Sediment resulting from the effects of gravity on the fill (slumps, raveling, etc.) being deposited in or carried by runoff to typed water
Cut slope failure	Sediment resulting from the effects of gravity on the cut slope (slumps, raveling, etc.) being carried by ditch flow to typed water

Findings for Statewide Roads and Haul Routes

This section summarizes data from both the Roads Field Forms and Haul Route Field Forms.

Roads Findings

Road construction or abandonment occurred on an estimated 591 FPAs in the 2014 sample. The resulting Roads prescription sample size was 6, and a total of 30 rules were evaluated.

Table 15. FP Rule Compliance for 2014 Road Activities

Statewide Road Activities for 2014		
	Status of Compliance	**Road Activities Rule Compliance**
All Landowner Types	# of Rules Sampled	30
	# Compliant Rules	28
	# with Deviation	2
	Compliance %	96%
	95% Confidence Interval*	CI (86, 100)

Sample size = 6
*CI is confidence interval at the 95% confidence level

Twenty-eight of the sampled 30 rules were compliant for the Roads prescription sample, resulting in a 96% compliance rate. Of the 6 sites sampled, 4 were 100% compliant and 2 showed deviation from at least 1 FP rule in the prescription type. At 1 of the noncompliant sites, water was observed running across the road surface due to an inadequately sized ditch, resulting in a deviation. The other noncompliant observation was the result of a drainage structure not installed at the natural grade of the stream. Both noncompliant rules had a rating of Low Deviation. (See Table 15.)

Haul Routes Findings

The Haul Route prescription sample included an inspection of haul routes along forest roads from the farthest points in the FPA to public access roads. In each sample, the entire road was observed if it was less than 5 miles long. If the entire road was over 5 miles, ten 0.5-mile-long road segments were observed. Within each 0.5 mile, every 0.1-mile segment was observed as to its actual or potential delivery of sediment to typed water; and the primary and secondary causes for the delivery (see Table17) were also recorded. The compliance monitoring field team recorded compliance information for haul routes in general and also specifically for haul routes categorized by side slopes less than or greater than 60%. The data for side-slope percentage provide information needed to fulfill requirements for Clean Water Act assurances. (For more information see *2009 Clean Water Act Assurances Review of Washington's Forest Practices Program.*)

Table 16. Haul Route Compliance Summary

Compliant		Deviation		
91% (80, 100) CI*		9% (0, 20) CI		
No Delivery	**De Minimis**	**Low**	**Medium**	**High**
87% (76, 99) CI	3.9% (0, 8.5) CI	3.1% (0, 7) CI	5.7% (0, 17) CI	0%

*CI is confidence interval at the 95% confidence level

Table 17. Haul Route Deviation by Cause

Primary Cause	% Deviation with This Primary Cause
Inadequate water crossing structures	2.6%*
Contaminated ditchwater	2.6%
Other (described in comments)	18%
Faulty cross drainage	2.6%
Stream of Spring Intercepted	5.1%
Road fill failure	2.6%
Sediment from stream adjacent parallel road	67%

*Over 60% of inadequate water crossings also exhibited ruts or inadequate crowns that contributed to sediment delivery.

The overall 2014 haul route compliance rate is 91% (Table 16). Sediment from stream adjacent parallel roads accounted for 67% of the deviations (Table 17). The 18% that aggregates the "other" category is comprised of non-point-source sediment delivery and blocked drainage structures (Table 17). For efficiency reasons, haul routes were observed on FPAs that had been selected for the harvest prescription sample. Since this is not an independent selection, there is some possibility of bias.

7. Forest Practices Application Compliance

Section 5 addresses compliance with the forest practices application (FPA).

Overall FPA compliance generally mirrors FP rule compliance on individual FPAs; however, occasionally one may be compliant while the other is not. When the prescription deviates from the FP rules but is compliant with the FPA, there are typically mistakes in the timber harvest design layout and/or approval process. When the FPA is compliant with FP rules but deviates from the landowner's stated protections on the FPA, typically the landowner proposed activities that were more conservative than what was implemented. (See Table 18.)

Table 18. 2014 Compliance with FPAs for Riparian and Wetland Harvest Prescriptions

	Status of Compliance	Western WA		Statewide					
		DFC1	DFC2	No Inner Zone Harvest	Np Activities	Ns Activities	Type A&B Wetlands	Forested Wetlands	Roads
Small Forest Landowners	# Compliant Rules	0	0	9	2	4	16	4	n/a
	# with Deviation	0	0	0	0	0	1	0	n/a
	% of Sample Compliant	n/a	n/a	100%	100%	100%	94%	100%	n/a
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	0	0	2	1	2	4	2	0
Large Forest Landowners	# Compliant Rules	52	42	38	54	23	41	13	29
	# with Deviation	3	1	3	1	0	0	1	1
	% of Sample Compliant	94.5%	97.7%	92.7%	98.2%	100%	100%	93%	95.7%
	Confidence Interval	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Prescriptions Assessed	8	6	8	13	12	10	7	6
All Landowners	# Compliant Rules	52	42	47	56	27	57	17	29
	# with Deviation	3	1	3	1	0	1	1	1
	% of Sample Compliant	94.5%	97.7%	94%	98.3%	100%	98.3%	94.4%	95.7%
	Confidence Interval	(90, 99)	(92, 100)	(85, 100)	(95, 100)	n/a	(95, 100)	(82, 100)	(86, 100)
	Prescriptions Assessed	8	6	10	14	14	14	9	6

Table 19. 2014 Comparison between FPA and Rule Compliance Assessments by Count

	RMZ Prescription	Total Prescriptions Sampled	FPA and Rule Compliance the Same	Deviation from FPA and Rule Compliant	FPA Compliant and Deviation from Rule	Deviation from Rule and FPA Indeterminate	FPA Compliant / Rule Indeterminate
Statewide	RMZ — No Inner Zone Harvest	10	10	0	0	0	0
	RMZ — Type Np Prescriptions	14	14	0	0	0	0
	RMZ — Type Ns Prescriptions	14	13	0	0	1	0
	WMZ — Type A&B Wetlands	14	12	1	1	0	0
	WMZ — Forested Wetlands	9	8	0	1	0	0
	Roads	6	6	0	0	0	0
Western WA	RMZ — Type S or F Inner Zone Harvest DFC1	8	8	0	0	0	0
	RMZ — Type S or F Inner Zone Harvest DFC2	6	6	0	0	0	0

Findings for FPA/FP Rule Compliance Differences

There are few differences between FPA compliance and FP rule compliance for the 2014 sample. Differences were found in the statewide Type Ns and Type A&B Wetlands prescription samples. (See Table 19.)

Within the statewide Type Ns prescription, the difference occurred as a deviation from the FPA/Rule Compliant, where the landowner treated the stream as an Ns but it was determined to be an Np by the CMP. The landowner used ambiguous "typing" related language on the FPA. The FPA indicated that if no flowing water was observed in the channel, the stream would be typed Ns for harvest related operations. Neither the Water Type Modification Form nor related Interdisciplinary Team documentation was received by region FP staff. During the compliance monitoring field visit, flowing water was observed in the channel, resulting in the determination of Type Np water. The field visit occurred in September, near to the time of seasonally low water flows. The sample was concluded to be a deviation from FP rules; however, due to the ambiguous language on the FPA, application compliance was rated Indeterminate.

Within the Type A&B Wetlands prescription, 2 samples deviated from either rule or application compliance. For the first sample, the landowner declared on the FPA that a 50-foot no-cut buffer would be utilized around a Type B wetland, when only 25-foot no-cut buffer was required by FP rules. During the compliance monitoring site visit, it was observed that the landowner met the 25-foot requirement but harvested within 50 feet of the wetland. The sample was compliant with FP rules but not compliant with the language on the FPA. For the second sample, the landowner declared that the selected wetland was Type A. However, during the compliance monitoring field review, it was determined that the wetland was an associated wetland of a fish-bearing water. This determination resulted in the sample being compliant with the FPA but deviating from the FP rules.

8. Report Discussion

Discussion regarding results in this annual report is limited because data collected are only for 1 year of a 2-year sample. The 2016 biennial report will utilize the combined data from both the 2014 and 2015 field seasons for results, discussion, and conclusions.

Riparian and Wetland Compliance Proportioned across the Population

Tables that describe 2014 riparian and wetland findings are located in Sections 3.2, 3.3, and 3.4 for individual prescription types. Section 3 also provides estimates of the population sizes for each prescription type. Table 20 (below) summarizes FP rule compliance according to these estimated populations. The sampling methodology employed provides desired precision for a biennial sample but does not support an unbiased way to combine rates and weight by their proportion in the population. Therefore, CMP cannot offer, for example, an overall compliance rate for fish-bearing streams.

Table 20. 2014 Estimated Population Size and Associated FP Rule Compliance

Prescription Type	Estimated Population of FPAs with the Prescription	Compliance %
RMZ — Type Np Prescriptions	322	98%
RMZ — Type Ns Prescriptions	356	96%
RMZ — Type S or F No Inner Zone Harvest	264	92%
Forested Wetlands	104	94%
Type A&B Wetlands	53	98%
Western WA RMZ — Type S or F Inner Zone Harvest DFC2	49	98%
Western WA RMZ — Type S or F Inner Zone Harvest DFC1	18	95%
Roads	591	96%
Haul Routes	2,273	91%

CMP Challenges

Representation of Complete Compliance

In this annual report, there is a danger with interpretation and perception when compliance rates are calculated and presented. The reader should avoid interpreting a deviation assessment as a failure of the prescription. Such a rating is merely an assessment of whether or not the prescription was in compliance with the affected FP rules included in the prescription. In most scenarios where there is deviation from at least 1 FP rule in the prescription, there is compliance with the remaining FP rules in the prescription. In fact, it is not unusual for prescriptions rated with a minor deviation to also exceed rule requirements for some FP rules. For example, with DFCs, if there were too few outer zone trees, there were often also excess trees in the inner zone, where trees have greater riparian benefits to

streams. In this example, the letter of the rule may not have been met, but many more trees remained in the RMZ than the minimum required by rule.

The expectation is for landowners to follow all FP rules. However, there is more to evaluating compliance with FP rules than simply a compliance rating for prescription types. The CMP continues to work toward finding better ways to report a more complete picture of the results.

Sample and Measurement Error

The CMP resolves the inability to determine statistical variability for average values by assigning a standard absolute 5% measurement error tolerance. This measurement error tolerance applies for only 2 specific measurements: when determining 1) leave tree to edge of bankfull width; or 2) buffer widths and lengths or floors within no-harvest RMZ areas. When a landowner's buffer is within 5% of the compliance monitoring field team's measured buffer, the values are considered the same. If the landowner's buffer value falls outside the 5% error tolerance, the compliance monitoring field team's measured buffer is assumed to be correct and the landowner's buffer incorrect.

Measurement methods involving averages such as stream width continue to be contentious because of the application of the absolute error value of 5%. This becomes problematic when the stream width is very near the threshold width. Imposing the set value of 5% may appear imprudent when there is high variability in individual stream width measurements.

Variation in Natural Conditions

Because natural features are variable, on-site conditions do not fit neatly into FP rule categories. When this occurs, review team members may opt to record the compliance as Indeterminate. The challenge is to improve understanding of the conditions and rule to minimize and ultimately eliminate Indeterminate determinations. This may involve revisiting rule interpretation and how to apply the rules in imprecise situations or developing suggested changes to make FP rules clearer.

Shade

Shade is a key function provided by the RMZ and as such is of interest to the CMP for monitoring. However, compliance monitoring of riparian shade rules has presented challenges that have precluded the ability to monitor for shade compliance.

Checking shade documentation for compliance and taking measurements in the field to determine if the required amount of vegetation was left to meet temperature standards both continue to be issues. Measurement repeatability is of concern when using a densiometer (the instrument used to determine shade). Also, when the compliance monitoring field team conducts an on-site review, the trees have been harvested, so it is impossible to re-create original conditions. Currently, the CMP does not take shade measurements in the field.

9. Forest Practices Program/Forest Practices Rule Changes Based on Compliance Monitoring Feedback

Several rule and Board Manual updates are currently in process as a result of the 2012–2013 CMP biennium report. Leave tree, DFC, and RMZ length rule and Board Manual clarifications are currently under review and will be completed by 2016. Rule and Board Manual clarifications were presented at the May 2015 Forest Practices Board meeting.

10. Glossary

bankfull width (BFW).

a) **For streams** — The measurement of the lateral extent of the water surface elevation perpendicular to the channel at bankfull depth. In cases where multiple channels exist, bankfull width is the sum of the individual channel widths along the cross section (see Board Manual, Section 2).
b) **For lakes, ponds, and impoundments** — The line of mean high water.
c) **For tidal water** — The line of mean high tide.
d) **For periodically inundated areas of associated wetlands** — The line of periodic inundation, found by examining the edge of inundation to ascertain where the presence and action of waters are so common and usual, and of so long a duration in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland.

basal area. The area in square feet of the cross section of a tree bole measured at 4.5 feet above the ground.

Bull Trout Habitat Overlay. Those portions of Eastern Washington streams containing bull trout habitat as identified by the Department of Fish and Wildlife's bull trout map.

channel migration zone (CMZ). The area within which the active channel of a stream is prone to move, resulting in a potential near-term loss of riparian function and associated habitat adjacent to the stream, except as modified by a permanent levee or dike. For this purpose, "near-term" means the time scale required to grow a mature forest. (See Board Manual, section 2, for descriptions and illustrations of CMZs and delineation guidelines.)

clear-cut. A harvest method in which the entire stand of trees is removed in 1 timber harvesting operation (except for trees required by rule or law to be left uncut).

confidence interval. A type of interval estimate of a population parameter, used to indicate the reliability of an estimate. Confidence intervals consist of a range of values (interval) that act as good estimates of the unknown population parameter.

crown closure. The percentage of canopy overlying the forest floor.

desired future condition (DFC). The stand conditions of a mature riparian forest at 140 years of age, the midpoint between 80 and 200 years. Where basal area is the only stand attribute used to describe 140-year-old stands, these are referred to as the "target basal area." The DFC is a reference point on a pathway and not an endpoint for forest stands.

diameter breast height (DBH). The diameter of a tree at 4.5 feet above the ground measured from the uphill side.

dominant and co-dominant trees.

a) **dominant** — Trees or shrubs with crowns receiving full light from above and partly from the side. Typically larger than the average trees or shrubs in the stand, with crowns that extend above the general level of the canopy and are well developed but possibly somewhat crowded on the sides.

b) **co-dominant** — A tree that extends its crown into the canopy and receives direct sunlight from above and limited sunlight from the sides. One or more sides of a co-dominant tree are crowded by the crowns of dominant trees.

equipment limitation zone (ELZ). A 30-foot-wide zone measured horizontally from the outer edge of the bankfull width of Type Np or Ns waters. ELZ rules apply to all perennial and seasonal non-fish-bearing streams.

end hauling. The removal and transportation of excavated material, pit or quarry overburden, or landing or road cut material from the excavation site to a deposit site not adjacent to the point of removal.

finite population correction factor. A formula frequently used in statistics and probability that allows adjustment to a population from larger to smaller or to indicate no change in the population. The result of the formula's calculation is called the "z-factor."

forest practices application or notification (FPA or FPN). The DNR form used by forest landowners to apply for approval of a class III or IV forest practice or to notify DNR that they are conducting a class II forest practice.

a) **FPA** — An application for a permit to conduct a site class III or IV forest practice. Site class III and IV forest practices have a higher potential to impact a public resource than does a site class II forest practice.
b) **FPN** — A notification to DNR that a class II forest practice will take place. Class II forest practices have less than ordinary potential to damage a public resource.

forest road. Since 1974, lanes, roads, or driveways on forestland used for forest practices. "Forest road" does not include skid trails, highways, or local government roads except where the local governmental entity is a forest landowner. For road maintenance and abandonment planning purposes only, "forest road" does not include forest roads used exclusively for residential access located on a small forest landowner's forestland.

full bench road. A road constructed across a slope without using any of the material removed from the hillside as part of the road. This construction technique is usually used on steep or unstable slopes.

laser hypsometer. An instrument that measures the distance to the top and bottom of an object and that measures the angle between the lines from the observer to each top and bottom to calculate height of the object.

100-year flood level. A "100-year" event means a calculated flood event flow based on an engineering computation of flood magnitude that has a 1% chance of occurring in any given year.

partial cut strategy. The removal of a portion of the merchantable volume in a stand of timber so as to leave an uneven-aged stand of well-distributed residual, healthy trees that will reasonably utilize the productivity of the soil.

prescription. A grouping of similar rules by forest practices activity type (e.g., No Inner Zone Harvest, Desired Future Condition Option 1, Desired Future Condition Option 2, Non-Fish-Bearing Perennial Stream, Non-Fish Bearing Seasonal Stream, Type A&B Wetlands, Forested Wetlands, Roads, and Haul Routes).

public resources. Water, fish, and wildlife; also, capital improvements of the state or its political subdivisions.

riparian function. Includes bank stability, the recruitment of woody debris, leaf litter fall, nutrients, sediment filtering, shade, and other riparian features important to both riparian forest and aquatic system conditions.

riparian management zone (RMZ). The area located on each side of a Type S, F, or N stream, where trees are left to provide protection from disturbance when forest practices activities such as timber harvest are conducted.

sensitive sites. Areas near or adjacent to Type Np water and that have one or more of the following:

a) **headwall seep** — A seep located at the toe of a cliff or other steep topographical feature and at the head of Type Np water, connecting to the stream channel network via overland flow and characterized by loose substrate and/or fractured bedrock with perennial water at or near the surface throughout the year.
b) **side-slope seep** — A seep within 100 feet of Type Np water located on side slopes with grades greater than 20%, connected to the stream channel network via overland flow and characterized by loose substrate and fractured bedrock, excluding muck with perennial water at or near the surface throughout the year. Water delivery to the Type Np channel is visible by someone standing in or near the stream.
c) **Type Np intersection** — The intersection of 2 or more Type Np waters.
d) **headwater spring** — A permanent spring at the head of a perennial channel. Where a headwater spring can be found, it will coincide with the uppermost extent of Type Np water.
e) **alluvial fan** — A depositional landform consisting of a cone-shaped deposit of waterborne, often coarse-sized sediments.

sidecast. The act of moving excavated material to the side and depositing such material within the limits of construction or dumping it over the downhill side and outside the limits of construction.

significance level. A fixed probability of wrongly rejecting the null hypothesis H0, when the hypothesis is in fact true. The smaller the significance level, the better the protection for the null hypothesis. Including a significance level prevents the investigator, as far as possible, from inadvertently making false claims.

site class. A growth potential rating for trees within a given area based on soil surveys. The designated site class along Type S or F streams will determine the width of the RMZ.

site index. An index based on ranges of site classes. For example:

50-year site index range (state soil survey)

Site class	Years
I	137+
II	119–136
III	97–118
IV	76–96
V	< 75

stand requirement. The number of trees per acre, the basal area, and the proportion of conifers in the combined core and inner zone such that the growth of the trees would meet the desired future condition.

stream adjacent parallel roads. Roads (including associated right-of-way clearing) in an RMZ on a property that have an alignment parallel to the general alignment of the stream, including roads used by others under easements or cooperative road agreements. Also included are stream crossings where the alignment of the road continues to parallel the stream for more than 250 feet on either side of the stream. Not included are federal, state, county, or municipal roads not subject to forest practices rules, or roads of another adjacent landowner.

temporary road. A forest road constructed and intended for use during the life of an approved FPA or FPN.

uppermost point of perennial flow. The point in the stream where water begins to flow perennially (year-round) downstream.

wetland management zone (WMZ). The area located around the perimeter of a wetland where trees are left to provide protection from disturbance, as well as shade and nutrients for the wetland.

yarding corridor. A narrow, linear path through an RMZ to allow suspended cables necessary to support cable logging methods, or to allow suspended or partially suspended logs to be transported through these areas by cable logging methods.

11. Appendix A: Statistical Methods

Methods for Confidence Intervals

There are 2 types of compliance proportions estimated in this report: simple proportions and ratio proportions. Estimation for both types is described below, with examples.

Simple Proportions

Most compliance proportions estimated in this report are simple proportions. FPAs containing individual prescriptions are sampled until the target sample size is reached. One prescription is evaluated for each FPA, so the compliance proportion is simply the number of compliant FPAs divided by the total sampled for each prescription. This is a binomial proportion, and 95% confidence intervals were estimated using the F-distribution as described in Zar (1996: 524):

$$LCL = \frac{X}{X + (n - X + 1) * F_{\alpha(2),\nu 1,\nu 2}},$$

$$UCL = \frac{(X + 1) * F_{\alpha(2),\varpi 1,\varpi 2}}{n - X + (X + 1) * F_{\alpha(2),\varpi 1,\varpi 2}},$$

where
LCL = lower confidence limit,
UCL = upper confidence limit,
X = the number of compliant activities,
n = the total number of activities, and
F = the F-distribution critical value for the given alpha and degrees of freedom,
$\nu 1 = 2(n - X + 1)$,
$\nu 2 = 2X$,
$\varpi 1 = 2(X + 1)$,
$\varpi 2 = 2(n - X)$.

These binomial confidence intervals are not symmetric.

Because there is a finite population of FPAs, the confidence intervals are corrected using the finite population correction factor. The overall population size for each prescription (i.e., the number of completed FPAs containing the prescription) is not known, but can be estimated based on the number of FPAs that were opened and found to be part of the population containing the given prescription. We estimate $\widehat{N}$ for an individual prescription as follows:

$$\widehat{N} = \frac{n_1 \times F_1}{f_1},$$

where
F_1 = the total number of FPAs approved in Year 1,
f_1 = the number of FPAs evaluated for membership in the population ("opened") in Year 1, and

n_1 = the number of FPAs opened that contained road/riparian prescriptions in Year 1.

The finite population correction factor (FPCF) is $1 - \frac{n}{\hat{N}}$.

To correct the confidence intervals for the finite population, we follow the equation in Zar (1996: 527) as follows:

$$LCL_c = \frac{X - 0.5}{n} - \left(\frac{X - 0.5}{n} - LCL\right) \times \sqrt{1 - \frac{n}{\hat{N}}}\ ,$$

$$UCL_c = \frac{X + \frac{X}{n}}{n} + \left(UCL - \frac{X + \frac{X}{n}}{n}\right) \times \sqrt{1 - \frac{n}{\hat{N}}}.$$

It is possible for the upper confidence bound to exceed 100%. In these cases, the confidence bound is set to 100%.

Example

The proportion of statewide Type A Wetland prescriptions that are compliant is an example of a simple proportion. For 2012, there were 12 FPAs containing Type A Wetland prescriptions that were evaluated for application compliance. Of these, 10 out of 12 were compliant with the application:

$n = 12$
$X = 10$

$\frac{10}{12} = 0.83$ (83% compliant)

$\nu 1 = 6$
$\nu 2 = 20$
$\varpi 1 = 22$
$\varpi 2 = 4$

$$LCL = \frac{10}{10 + (12 - 10 + 1) * 3.128} = 0.52(52\%)$$

$$UCL = \frac{11 * 8.533}{12 - 10 + (11) * 8.533} = 0.98(98\%)$$

The population estimate for 2012 Type A Wetlands is 54. Correcting for finite populations,

$$LCL_c = \frac{10 - 0.5}{12} - \left(\frac{10 - 0.5}{12} - 0.52\right) \times \sqrt{1 - \frac{12}{54}} = 0.55\ (55\%)\ ,$$

$$UCL_c = \frac{10 + 0.83}{12} + \left(0.98 - \frac{10 + 0.83}{12}\right) \times \sqrt{1 - \frac{12}{54}} = 0.97\ (97\%)\ ,$$

In this case, the FPCF changed the confidence interval from (52, 98) to (55, 97).

Ratio Proportions

Some compliance proportions are estimated using a ratio proportion. This is necessary when both the numerator and the denominator of the proportion are random variables. The only estimation that used a ratio proportion was the haul route analysis. The haul route compliance for each FPA is the length of road that is compliant divided by the length of road evaluated. The denominator of the compliance ratio is a random variable because the length of road being evaluated differs among FPAs. In this case, the estimated compliance proportion is

$$\hat{p} = \frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i}\ ,$$

which is the total length of compliant haul route segments divided by the total length of haul route segments that were sampled across all FPAs (*n* is the number of FPAs sampled).

A 95% confidence interval for the proportion compliant is formed as follows:

$$\hat{p} \pm t_{.025,(n-1)} \cdot SE(\hat{p}))\ ,$$

where $t_{.025,(n-1)}$ is the 97.5th percentile of the student-*t* distribution with (*n*–1) degrees of freedom, *n* is the number of sampled FPAs, and

$$SE(\hat{p}) = \frac{\sqrt{n \cdot (1 - \frac{n}{N}) \cdot \sum_{i=1}^{n} (y_i - \hat{p} x_i)^2}}{\sqrt{(n-1)} \cdot \sum_{i=1}^{n} x_i}$$ (Cochran 1977: 32).

These confidence intervals are symmetric. Note that the FPCF is already built in to this equation. It is possible for the upper confidence bound to exceed 100% — in these cases the confidence bound is set to 100%.

12. Appendix B: Bankfull Width Error Tolerance

Board Manual (Section 2.1.3) prescribes a sample of at least 10 evenly spaced measurements over 500 feet to determine average bankfull width (BFW). Several cases have arisen using the Board Manual stream width protocol in which the outcome of the review field sample average is very close to the threshold value where the required riparian management zone (RMZ) width changes. A formula based on sample error will be used to determine compliance, to determine the probability that 1) a landowner could have followed the proper procedures for measuring BFW; and 2) the landowner's measured result is less than 10 feet. The basis for this determination is 20%. Two examples follow:

Example 1

Station	BFW (ft)	
0	n/a	
50	15	
150	17.5	
250	13.5	
350	14	
450	7	
550	12.7	
650	12	
750	9	
850	14	
950	7	
1050	13	
1150	10	
1250	13	
1350	12	
1450	23	
1550	6	
1650	13.5	
1750	33	
1850	16	
1950	3	
	264.2	Sum
	20	Count
	13.21	Mean
	6.41937	SD

Using a t-distribution instead of a normal distribution because the variance is an estimate, we estimate that the probability that a landowner could have measured this stream and recorded an average BFW less than 10 feet to be 7.4%. This means that we estimate a less than 1 in 10 chance that a landowner could have measured an average BFW of less than 10 feet following proper procedures. If a landowner had called this a small stream, we would consider this a deviation from compliance.

Example 2

Station	BFW (ft)	
50	5.5	
150	9	
250	5.5	
350	5	
450	7	
550	8	
650	20.5	
750	15.5	
850	7	
950	5	
1050	19	
1150	13	
1250	7.5	
1350	13.5	
1450	24	
	165.00	Sum
	15	Count
	11.00	Mean
	6.230684	SD

Using the same process as in Example 1, we estimate the probability that a landowner could have measured this stream and recorded an average BFW of less than 10 feet to be 31.2%. This means there is an 1 in 3 chance that a landowner could have measured a BFW of less than 10 feet following proper procedures. Thus, we cannot be sure that a landowner did not follow the rules, because there is a greater than 1 in 4 chance that the landowner did follow the rules and still got a measurement of less than 10 feet. This stream would be compliant.

13. References

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